The Chemical Age

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Fertilisers—and Superphosphate

HOW did the conscious use of fertilisers originate? Which was the first fertiliser to be used in quantity? Dr. W. S. Landis, in his speech following the presentation of the Chemical Industry Medal, has sent us back to folklore and to such sciences as deal with the life of primitive man for an answer to these questions. He gives evidence for believing that agriculture was started by the females of the species since their maternal cares rendered them more liable to food shortage so long as they depended for supplies on the chase. He suggests also that primitive graves would be decorated much as they are to-day with flowers, and that it would be observed that seeds grew more quickly on the newly disturbed earth. Following that would come the observation that growth was aided by animal droppings. The Romans knew that lime and wood ashes were beneficial, but one would have suspected that the value of bones would have been discovered by the primitive peoples. It may be that this discovery escaped them because the bones that were scattered around the camps were not crushed.

In this country Sir J. B. Lawes discovered, about 1840, the scientific basis of phosphate fertilisers by reason of a neighbour's observation that the effectiveness of bones varied from place to place. Mr. Edward Packard, in 1854, erected the first complete superphosphate factory. His grandson, Mr. Walter Packard, has contributed an interesting account of the superphosphate industry to the Institution of Chemical Engineers which was summarised in our columns last week. Lawes, it appears, was not the discoverer of superphosphate; the honour must go to Escher and to Liebig. About 1850, Dumas wrote that the consumption of ammonia salts would be increased if they were introduced into agriculture for manurial purposes, on which point experiments were going on in several countries.

Mr. Packard makes it clear that the British insistence on a guarantee of water solubility, rather than of solubility in other solvents, is in the best interests of agriculture. It is interesting that some early inventors believed that water solubility would militate against the effective use of fertilisers, whereas now fertilisers are generally soluble in water, and we are even considering the use of the comparatively volatile ammonium bicarbonate for the purpose. The difficulties of the superphosphate manufacturer are many, and probably arise not least from the curious circumstances mentioned by Mr. Packard that almost every phosphate reacts in a different manner with acid and even different cargoes may behave differently, probably owing to variations in the geological formation; in this respect phosphate rock is like coal, whereof no two seams are alike and the same seam may differ from place to place. We gather that rather less is known about the correlation of the constitution of phosphate rock with its behaviour than about the equivalent properties of coal, and to that fact many of the operating difficulties may be ascribed.

Other important factors in manufacture are the degree of concentration of the acid used which must be neither too strong to produce free phosphoric acid nor too weak to provide insufficient water for the reaction; the temperature of the acid should be around 100° F.; the fineness of grinding prior to the reaction is important, but far from being a subject on which there is general agreement.

Apparently the fineness of grinding may be correlated with the strength of the acid since it is recorded that the Broadfield process for making dry superphosphate uses a stronger acid than is customary because the mixing is more thorough. The quantity and concentration of the acid affects the yield of water-soluble material, and reversion may take place owing to the presence of iron and aluminium phosphates, and even owing to the pressure of superincumbent material. Another difficulty lies in the plant; like many another old-established industry, superphosphate manufacture is burdened with old factories that are singularly difficult to convert, though in a modern works not a shovel nor a barrow is used from the time the phosphate enters until the superphosphates leaves. Many British industries are having to face this problem of modernisation.

Among recent developments mentioned by Mr. Packard is the manufacture of dry phosphate. The problem has been to produce material containing 2 to 4 per cent. of water instead of 12 to 16 per cent. It is not altogether clear what is the principle underlying all these new processes, but it appears that many of them depend on using stronger acid, made possible by more thorough mixing. Mr. Packard has great hopes of the Oberphos process which uses acid of the same strength as in the old den process, but allows the exothermic reaction to proceed in an autoclave so that the temperature rises, the reaction takes place under pressure and the increased violence of the reaction dries the superphosphate. Yet another parallel development has been recorded by Dr. Landis in the combination of ammonia and phosphoric acid to form "concentrated fertilisers" such as "Ammo-phos." Dr. Landis maintains that "the better equipped farms, the more intelligent direction, the relatively larger application, all favour the concentrated product. Special equipment appears to be necessary to use ammonium phosphate and the difficulty of the farmer in this direction appears to be the present limiting factor."

Notes and Comments

Food Research

DURING the past fifteen years some noteworthy results have been attained in the joint laboratories of the British Association of Research for the Cocoa, Chocolate, Sugar Confectionery, and Jam Trades and the British Food Manufacturers' Research Association at Holloway in the investigation of problems of many kinds affecting both confectionery and food products. A good deal has also been done in dealing with municipal and Government authorities in assisting in the determination of food standards, in legislation affecting food products generally and in advising wholesalers and retailers on the storage and preservation of food after it has been manufactured. An extension of the laboratories was opened last week by Sir William Bragg, president of the Royal Society, who mentioned that towards the cost of the research at Holloway the Government has contributed about £50,000 and the members of the trade about £110,000. It is often difficult, as Sir William remarked both at Holloway and at a similar function at the Launderers' Research Laboratories at Hendon a little while ago, to convince members of a trade of the importance of research. So much of it is of a long range character and a great many people are loth to give up what they regard as old and tried methods for something new. No-one has a greater respect for tradition than the research man, who realises that in tradition is often stored up some of the most valuable information he requires to assist him in his investigations.

Private Enterprise in Distressed Areas

AT the moment when the country is promised a new Bill to deal with the distressed areas, Mr. John Benn has done a useful service in calling attention to the responsibility of private enterprise in this matter. In a letter to "The Times," he describes the successful venture of a London furniture manufacturer, who has started a branch factory at Jarrow. After a year's working this has proved a commercial venture on account of the saving in carriage charges to Scotland and the North of England on goods previously supplied from London. Some of the young workmen are already earning as much as their fathers earned as skilled workmen in the shipyards ten years ago. In other parts of Durham, Mr. Benn saw vacant factories available almost for the asking, which "require little repair and are palaces as regards light and space compared with many of the crowded factories in East London." Any business man who will explore the position for himself is assured of an eager welcome, and will probably be surprised at the opportunities available for new enterprise. Whatever methods the Government may adopt, the distressed areas will only be cured when sufficient new industries have been established on normal commercial lines. The furniture factory at Jarrow therefore provides a significant and encouraging example. The recent report of the Special Commissioner refers to a number of other firms which have launched out into South Wales, Durham and Cumberland. THE CHEMICAL AGE, believing such enterprise to be of the highest national value, would welcome details from any of the firms concerned.

Inventive Activity

DESPITE a falling off in the number of patents applied for in Great Britain in 1936, it will probably be found when the full records for the year come to be examined that there was no actual diminution of activity. Applications in 1936 totalled 35,900, compared with 39,898 in the peak year (1929), and although we shall have to wait some months for the Comptroller's detailed report it is reasonable to assume from a cursory examination of the patent applications recorded in THE CHEMICAL AGE week by week that the trend of inventiveness in the sphere of dyes and dyeing and kindred chemical enterprises noted in the Comptroller's report for 1935 has been continued throughout the past twelve months. As was pointed out by Gee and Co., patent agents, who sent us the statistics published in our last issue, only about 50 per cent. of the patents applied for mature into full patents, and it may well be that the decrease in applications will be found to have been entirely offset by an increase in the number of patents granted. The British Industries Fair usually yields a crop of new inventions. As in previous years the Institute of Patentees has been appointed to advise exhibitors on all matters relating to patents, designs and trade marks and will have stands for this purpose at Olympia and Castle Bromwich. A point to be borne in mind in connection with the Fair is that the fact of the Fair being certified by the Board of Trade to be an industrial exhibition recognised for the purposes of the Patents and Designs Acts does not in itself enable exhibitors to show unprotected inventions without prejudicing their rights therein. It is essential before exhibiting to file a description of an invention in the prescribed form at the Patent Office.

"Why Do We Manufacture?"

IN our leading article of January 2 we asked "Why do we Manufacture?" and in discussing the question we said that "whatever may be the actual terms of the answer, one thought must clearly run through every reply and that is the desire to make profits. . . . The real object of industry is to provide people with the things they want." Included in the article were passages from the address on "The Society, the University and the Industry," which Professor T. P. Hilditch delivered in October as chairman of the Liverpool section of the Society of Chemical Industry. Professor Hilditch has complained to us that, divorced from their context, the passages in question conveyed an entirely wrong impression, inasmuch as they were not his own remarks, but were themselves quotations of statements and opinions expressed fifty years ago. Professor Hilditch's address was purely historical, not political or ethical, and our leader was intended to be a new year reminder of the need for a better realisation of the ultimate objects of industry. The two matters were entirely unrelated except in so far as the remarks made in 1887 and quoted by Professor Hilditch served to illustrate the points we sought to make. We offer to Professor Hilditch, who was formerly a works research chemist of many years' experience, our apologies for the misconstruction.

Analytical Reagents and Research Chemicals

A Contribution from the Laboratories of The British Drug Houses Ltd.

CHEMICALS used as reagents in analytical work must be of a sufficient degree of purity to ensure that in every case they will give the desired reaction and will not introduce impurities which will make their appearance at a later stage of the analysis. As an illustration of the risk of being misled by impurities present in reagents an instance which occurred some years ago may be cited. Research was being conducted in various laboratories with a view to finding a reliable colour test for vitamin A in cod-liver oil and it was found, and for a time was accepted, that trichloroacetic acid gave a blue colour with the vitamin. Efforts were made in the B.D.H. analytical laboratories to apply this as a quantitative method when it transpired that although good colours were obtained with an impure acid, no colour whatever developed when a highly purified trichloroacetic acid was used. Further investigation showed that much of the trichloroacetic acid in use contained traces of phosgene and that it was the presence of this impurity that caused the colour formation.

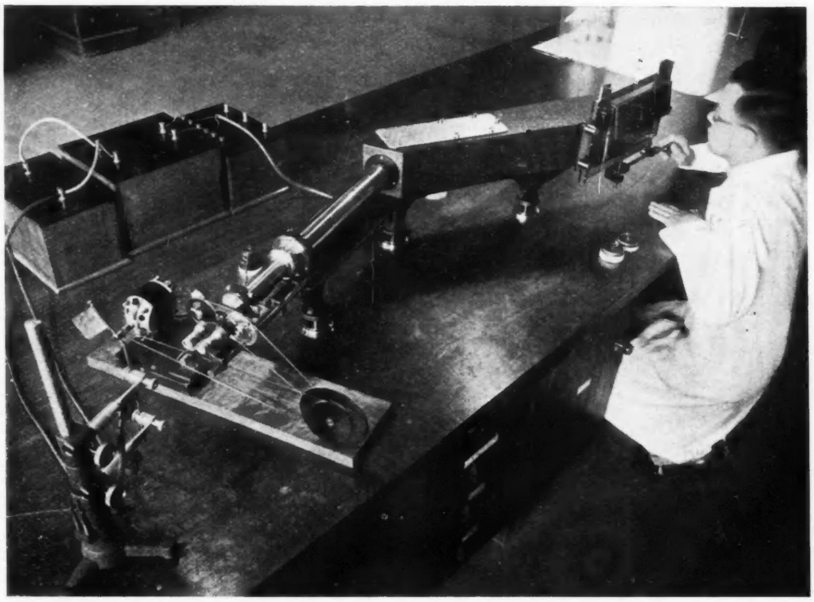

Fig. 1.—Quartz spectrophotometer in use in the B.D.H. Laboratories.

Traces of impurities that catalyse reactions may lead to erroneous inferences; for this and many like reasons it is of the greatest importance that analytical reagents should be as free as practicable from all impurities. Absolute freedom from impurities, however, can only rarely be achieved and purification to the point necessary for analytical purposes is only effected in a few chemical substances which are produced on a commercial scale; consequently the manufacturer of reagent chemicals must purify them specially and work to a specification which strictly limits and defines the permitted amounts of impurities. Manufacturing operations must be carried out under very strict conditions of analytical control, employing varied and repeated processes of purification carried on until the full specification is complied with. Such chemicals can then be supplied with a guaranteed statement of the maximum limits of the impurities which may be present, so that the user knows exactly the maximum amounts that may be introduced in the course of his work. In the book of "AnalaR Standards," published by the B.D.H. Ltd., and Hopkin & Williams Ltd., the exact conditions under which the tests are to be applied are stated, together with the limits to which these tests correspond.

The methods of manufacture of such chemicals do not

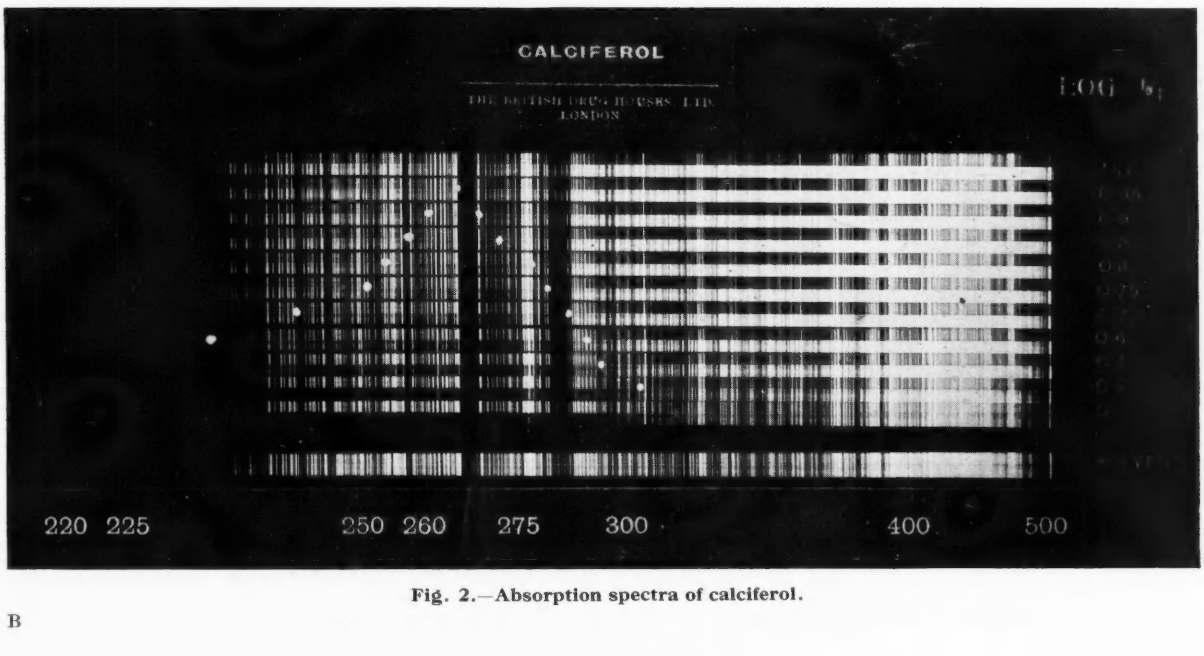

Fig. 2.—Absorption spectra of calciferol.

necessarily differ from those adopted in making the ordinary pure grades, but they must proceed with constant repetitions. Impurities are removed by precipitation or adsorption, wherever possible, and in many cases recourse has finally to be had to processes of repeated recrystallisations with temperature control under conditions of fractionation. The supervision of a trained chemist and extreme care and attention to detail are necessitated at all stages of manufacture. During the precipitation of impurities, the exact amount of precipitating agent that will give the *best* results must be used, although this may not necessarily remove the whole of the impurity. A greater amount might introduce a more objectional impurity than the one it was desired to remove. At each stage of the recrystallisation great care must be taken to remove, as far as possible, the whole of the mother liquor and to rinse lightly the surface of the crystals with fresh solvent. It is only by such means that extreme purity can be obtained.

Strict Analytical Control Essential

From the beginning to the end of the manufacturing stages strict analytical control is essential, and the final product before being passed into stock must conform to the particular specification in all respects. In spite of all this care in manufacture it is of supreme importance that a final analysis should be carried out in a laboratory quite distinct from the one attached to the manufacturing department where the process samples are tested. By this arrangement a double check is provided. At the B.D.H. works the final analysis is conducted in a central analytical laboratory where complete records of every batch of material are filed and are instantly available for reference. The system in vogue provides that every batch of chemicals, no matter what grade of purity, is given a serial number by which it can be identified for all time. In addition, no material can be issued for use or sale until it has been examined and passed by the central analytical laboratory; if such examination should prove the material to be satisfactory, the information is imparted to all concerned by the issue of a special initialled "passed" label bearing the name and serial number of the batch.

Spectroscopic Analysis

Although chemical analysis is relied on for most of the commoner inorganic reagents, it is necessary in some cases where extreme purity is required to resort to spectroscopic analysis, either in the visible or the ultra-violet region, or in both.

Fig. 1 shows the quartz spectrophotometer which is used for this purpose and also for the examination of certain organic substances for which no satisfactory chemical tests are available, as, for instance, calciferol or synthetic vitamin D. In such cases, it is usual to determine the absorption coefficient of a solution of the substance in some optically transparent solvent. By the extent of the absorption at particular wave-lengths the substance can be identified and evaluated.

The actual process involved in determining the absorption coefficient consists in taking, on the same plate, a series of pairs of photographs of the spectra produced by the light of a high tension spark from tungsten steel electrodes passing through 1 centimetre depths of the solution and of the solvent. By means of the photometer, the amount of light passing through the solution is progressively increased for each pair of the series and the dark slide is adjusted to expose a fresh portion of the photographic plate. The developed negative shows a number of spectra arranged in pairs in which the ratio of exposures of the two halves of each pair varies according to a pre-arranged plan. On this, the absorption curve is plotted by marking off the points of each pair that are equal in intensity (Fig. 2).

Metallic Impurities

For the detection and determination of traces of metallic impurities, the substance to be tested is "sparked" between copper electrodes or on a carbon arc. The elements present are then detected by the position of the spectrum lines shown in the photograph (Fig. 3), and the quantities may be determined by comparing the intensity of the lines with standards prepared from known concentrations. This method is used for the detection of minute traces of barium in strontium salts and lead in thallium compounds. Spectroscopic measurements in the visible region as obtained by the spectrophotometer (Fig. 4) are also used to identify and evaluate certain coloured organic reagents such as B.D.H. standard microscopic stains, and for the detection of didymium in cerium salts.

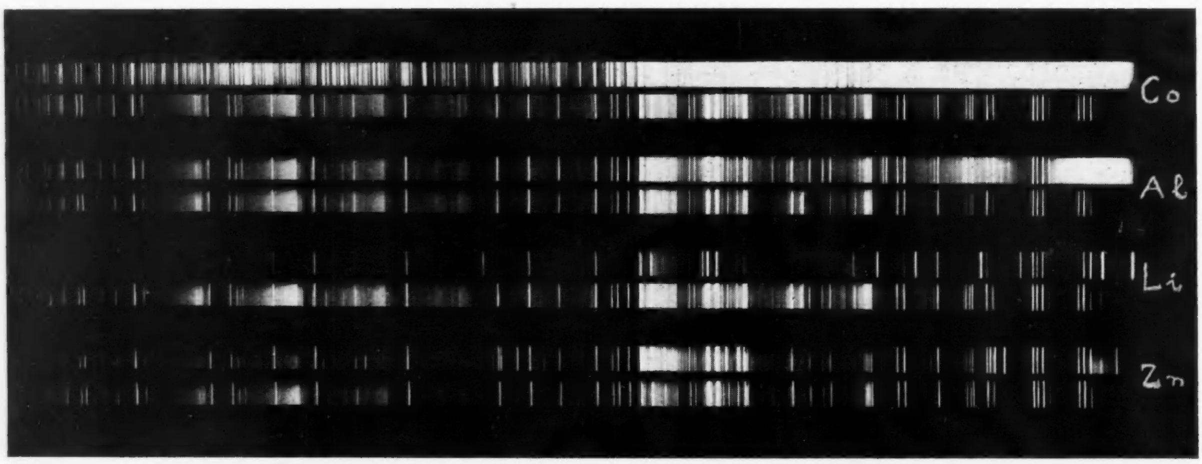

Fig. 3.—Spark spectra of metals on copper electrodes. The lower of each pair is copper alone.

Many organic chemicals used in research are optically active and their rotation as determined by the polarimeter (Fig. 7) is a useful criterion of their purity. It frequently happens that such substances are very expensive and only a very small quantity is available for testing, or the substance may be sparingly soluble, so that in either case, the determination must be carried out on a very dilute solution, 1 per cent. or less, and this necessitates an instrument of a high degree of precision. As the optical rotation is affected by temperature, water-jacketed observation tubes are used. Chemicals tested in this manner include some of the amino-acids, the sugars, certain alkaloids, calciferol and ascorbic acid.

Quantitative Colour Tests

During recent years, an increasing number of complex organic reagents producing well-marked colorations with certain metals have been found to be of use in the determination of traces of these metals. In the examination of these reagents it is of the highest degree of importance that they shall be uniform in their action; it is essential therefore to carry out quantitative colour tests to ensure such uniformity.

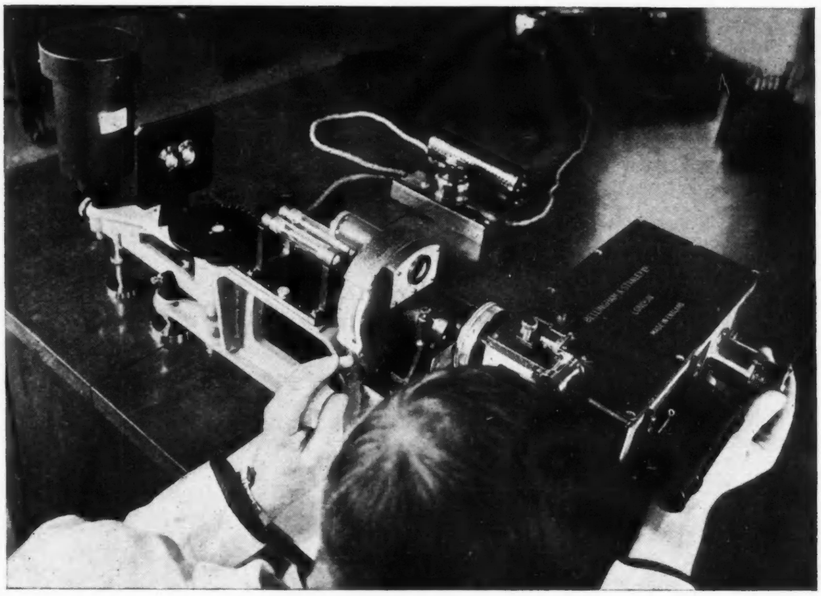

Fig. 4.—Spectrophotometer as used for the visible range.

Fig. 5.—B.D.H. pattern Lovibond Tintometer.

For this purpose, the tintometer (Fig. 5) is found to be invaluable, but it is absolutely essential to standardise the test, as most of the colours produced are either evanescent or due to matter in a colloidal state and very slight alterations in procedure often produce different shades or depths of colour.

Much research has been carried out in connection with tests of this nature and for a number of them which have arrived at a satisfactory stage of development permanent Lovibond glass colour standards have been prepared and fitted into discs for use with the B.D.H. Lovibond Nessleriser (Fig. 6) so that they are instantly available for testing the organic reagents and also for general use for the determination of traces various metals and radicles. By means of such permanent standards, minute amounts of ammonia, nitrites, phosphates, silica, iron, copper, free chlorine and dissolved oxygen in water can be rapidly determined.

Among the members of the staff of the B.D.H. analytical laboratory some are always engaged in research on new tests, and it is only by such work that it is possible to maintain the constant progress which is regarded as essential. Occasionally a reagent which has hitherto proved satisfactory in all respects, fails to give concordant results in a new test. Sometimes the method of applying the test is at fault: the most suitable conditions may not have been thoroughly worked out; or a minute trace of an unsuspected impurity is found to be present. In any case, it is the duty of the staff to discover just why the test is unsatisfactory, and, if it be due to an impurity in the reagent, to devise tests sufficiently sensitive to detect the impurity and so ensure its absence in future batches. The manufacturing departments must then be notified so that steps may be taken to remove the impurity during manufacture. If the impurity is such that it produces a distinctive reaction in a special test where no such reaction should occur, then that special test will most likely be the best for detecting the impurity. It is by such means that many of the most delicate tests are produced in the first instance.

Fig. 6.—B.D.H. Lovibond Nessleriser.

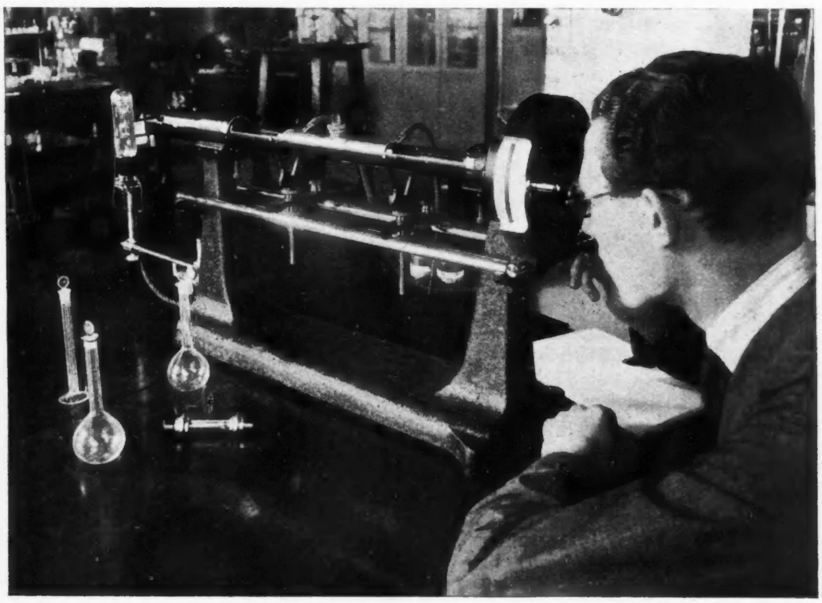

Fig. 7.—Polarimeter in use in the B.D.H. Laboratories.

Superphosphate : Its History and Manufacture

Discussion on Mr. Walter G. T. Packard's Paper

DR. WILLIAM CULLEN, vice-president, presided at a meeting of the Institution of Chemical Engineers on January 20, at which Mr. Walter G. T. Packard presented the paper on "Superphosphate : Its History and Manufacture," which was summarised in THE CHEMICAL AGE last week (pp. 67-70).

Opening an interesting discussion Mr. P. PARRISH said that in a recent article in the "Fertiliser Journal" he had suggested that best quality superphosphate should conform to certain limits, which he had specified as follows :—

Moisture content	Around 6 per cent., according to process.
Particle size	Nothing retained on a 5 x 5 I.M.M. screen ; 50-65 per cent. retained on a 50 x 50 I.M.M. screen ; 90 per cent. retained on an 80 x 80 I.M.M. screen.
Free phosphoric acid expressed as P_2O_5	1.5 to 2 per cent.

What appeared to him to be extraordinary, so far as the superphosphate industry was concerned, was the desire to carry such a large quantity of water. The water possessed no merit, except it was a factor contributing to adverse physical condition of the superphosphate. In his view there were three possible causes of cementing in calcium superphosphate. There was (1) the possible dissolution of monohydrated monocalcium phosphate by the water, (2) the presence of excess phosphoric acid constituting a desiccating agent that might attract moisture, and (3) the presence of very fine superphosphate, which had a large surface area, and which would undoubtedly become moist under certain conditions, due to causes 1 and 2.

He suggested that if the superphosphate industry wished to make a few thousand pounds, this could be done by reducing the moisture content to 5-6 per cent. Eight hundred thousand tons of calcium superphosphates were dealt with at the present time. On an average, the product would contain 10 per cent. of moisture, representing 80,000 tons. If the moisture content were reduced to 8 per cent. this would represent 40,000 tons, at an average carriage charge of 6s. per ton, representing £12,000. He put it to Mr. Packard that this was a suggestion meriting careful consideration.

Defects of the Oberphos Process

Mr. Parrish also narrated some experiences in the purchase of fertiliser works in the Midlands, and about his investigations of the special features of the trade. He said that there was little information at that time (1911) on certain technical aspects, and he was impressed with the fact that not more than 9d. per ton profit had been made on the manufacture of calcium superphosphate over a long period of years. He was convinced that consolidation of the industry was necessary, and had attempted, with his colleague, to arrange amalgamations embracing fertiliser works from the Tyne to the Wash. The industry, however, was not receptive to the idea.

Finally, Mr. Parrish made some comments concerning the newer processes—the Oberphos and the Broadfield—in relation to the old type of technique, and asked what were the desiderata to which regard should be had in deciding on a calcium superphosphate plant. In the first place, having regard to the bulks of raw material and final calcium superphosphate to be handled, what was important was (1) simplicity (the Oberphos plant, however, did not possess that merit); (2) the plant should give a final product which met all the conditions necessary as regards physical and chemical characteristics, and the product should be drillable; (3) the plant should be capable of erection at a minimum capital expenditure, as this influenced the cost of production; (4) the plant should be such as to admit of economic manufacture. That the Oberphos process did not fulfil all the foregoing desiderata was clear from what Mr. Packard had said in his paper. On the other hand, continuity of operation, as provided for by the Broadfield process, was a feature of importance. Equally, many of the so-called old plants were remarkably efficient, and peculiarly simple. Nevertheless, his firm was to be congratulated on having embarked on an important step. But whether their anticipation would be fully realised, as regards economical manufacture, time alone would reveal.

Mr. R. F. STEWART, in a written communication, said the paper dealt with the superphosphate known in England and Europe generally, a product containing about 16 per cent. soluble P_2O_5. To a small extent on the Continent and to a much larger extent in Canada and the United States, a product much richer in soluble P_2O_5 and known as double or triple superphosphate, depending on its composition, was produced in large quantities. This was much more troublesome to make, as phosphoric acid must first be made and concentrated to be used in mixing with the powdered phosphate rock in place of sulphuric acid in ordinary superphosphate. This product also had to be dried before shipment. It contained from 30 per cent. soluble P_2O_5 to 43 per cent. available P_2O_5 and had obvious advantages in countries where long hauls had to be undertaken, as a minimum of inert material was carried. The Dorr Co. was consulted regarding the solution by the Consolidated Mining and Smelting Co., of Trail, British Columbia, of a similar problem to that presented to the National Smelting Co., of Avonmouth, through the inevitable production of sulphuric acid as a by-product of zinc smelting.

Manufacture in British Columbia

At Trail, a nitrogen fixation plant was installed, using hydrogen made by electrolysis, and the fertilisers planned for production were ammonium sulphate, mono-ammonium phosphate and triple superphosphate, all products being as nodules. From a flow diagram of the strong phosphoric acid plant making an acid with 30 per cent. P_2O_5 it would be seen that double filtration on rotary vacuum filters was adopted for separating the acid from gypsum. The problem of corrosion and scale formation were specially severe compared with what was encountered in the manufacture of ordinary superphosphate, but were all eventually overcome. About 450 tons of Montana rock per 24 hours were treated in three sections of plant. The flow diagram of the plant installed for making triple-superphosphate was also interesting, especially as essentially the same installation could be used for making ammonium phosphate. In both cases, a circulating load was carried round the drying and screening plant resulting in well graded products. The iron and alumina phosphates (the so-called citrate solubles) served as binders for these nodules. The nodules were about 1/20th in. in diameter.

Mr. W. RUSSELL said it was mentioned in the paper that on the Continent and in America they were allowed to benefit from the di-calcium phosphate, whereas in this country it was only water soluble phosphate that counted. That was very regrettable because di-calcium phosphate had very good manurial value. In addition when the superphosphate was put on the ground, after the first shower of rain there was sufficient lime in the soil and the superphosphate was precipitated as di-calcium phosphate, but it never went down more than 9 in., and there was no excess of phosphate from the manure. This showed that if we were allowed to get some value from the di-calcium phosphate it would be a considerable advantage to superphosphate makers. Less acid would be required and a lower grade rock could be used. He put that forward as a suggestion which might be fought out between agriculturists and the phosphate makers, because he believed it would be an economy for both of them.

Mr. D. BOYD said the reduction of the moisture content to about 4 per cent. was largely a matter of cost. It was possible to get the moisture content down to 3 or 4 per cent., but he feared the cost would be prohibitive. In the Oberphos process the moisture content was 8 or 9 per cent. and the cost of doing so was reasonable, but the ideal to aim at, if a figure of 4 per cent. was to be reached, was to make a water soluble phosphate without the use of sulphate of ammonia at all because it was a waste of ammonia to convert to SO_2 and SO_3, add water and put it back into the phosphate and then throw it away on the land because it was of very little use. Perhaps that was a little more revolutionary than Mr. Parrish had in mind.

The Demand for Granular Superphosphate

As he was in the same firm as Mr. Packard he did not propose to criticise the Oberphos process, but at Lincoln, where he came from, they were very jealous of it. At Lincoln they were still producing superphosphate from the old circular den with a water content of 15 per cent., and when they saw the superphosphate which was being produced by the Oberphos process they were very jealous of it indeed. Judging by the sales of granular superphosphate in the North of England—it had now been on the market for two years—he was satisfied that in a few years the demand would be absolutely for granular superphosphate.

Mr. A. OGILVIE said that as an engineer it had struck him that, during the past 20 years, the efforts in the industry had all been directed towards a drier superphosphate with an equivalent increase in the water solubility, and everything that had been described in the paper led towards that end. Nevertheless, it was disappointing to him that an elaborate process like the Oberphos process had only, according to the paper, brought the moisture content down to an average of approximately 10 per cent. This was a very elaborate process and he would have liked some information of comparative costs. It was very strange how, in this industry, old processes survived. There was one very up-to-date works in this country where they were still using the Svenska process. This was one of the earliest dens and yet remarkably good results were being obtained with it.

Efforts in various works had been directed towards the mixing process and with these improved mixing processes such as using stronger acid, acid of higher temperature and controlling the period of mixing, it had been possible to bring the moisture content down to approximately 12 per cent., which indicated that probably the question of mixing had not been satisfactorily dealt with. Further, during the mixing process, gases were given off which contained moisture and efforts had also been concentrated on using a stronger draught. He believed the Broadfield process made use of a very strong draught during the process of mixing, and so carried off a great deal of moisture which in the older dens was allowed to settle back into the product and increase the moisture content. Experiments had also been carried out on the maintenance of an uniform temperature during mixing, which again helped the evaporation of the moisture remaining in the product.

Chemical Engineering Difficulties

Mr. J. D. VERSCHOYLE asked whether concrete could be used as a material of construction in these plants without any fear of chemical attack. He said he had been surprised to see from the paper that concrete had been used in three of the dens described.

Mr. STANLEY ROBSON said he would have liked to have heard more about the chemical engineering aspect of the subject. The mechanical difficulties in making superphosphate, from the engineering point of view, were quite considerable. The reaction apparently was quite simple, but the product presented manipulative difficulties of no mean order. They reminded him, as a metallurgist, of something of the problems which were created when one produced a slag which was too stiff to run and yet was not stiff enough to push. The evidence of that was to be seen in the many attempts which had been made to produce the different kinds of dens and equipment to handle what seemed to be such an elementary product in such an elementary process. The difficulties were very real and one thing that had to be remembered in making superphosphate was that the production must be made quite cheaply because it had to be sold cheaply.

The Oberphos plant was a very elaborate plant. The reaction was carried out in an autoclave giving it many advantages, but presenting many engineering difficulties which he would have liked to have heard more discussed. Nevertheless, the process presented many advantages in that it was aiming to produce a different material from the material produced by other processes and differing mainly in regard to its physical characteristics. The amount of water present was important, but the physical characteristics of the product were probably more important still. He noticed that the Nordengren process aimed to do the work in two steps involving two different stages of reaction. In the process stages were manipulative only in the sense of applying pressure, or allowing pressure to apply itself as the result of the reaction and evacuating the vessel rapidly. These were simple manipulative processes and they certainly did quite a product of distinctive physical characteristics.

The real problem in superphosphate making was the equipment. It might be said in regard to the Oberphos process that the autoclave looked a very large and very expensive equipment. It was undoubtedly both large and expensive, but the throughput of the autoclave was considerable, and the size of it in relation to the work performed was by no means large. The charge was put rapidly into the autoclave and the autoclave operation proceeded quickly to its conclusion, the material being discharged in many cases in a condition almost, if not quite, fit for use. He suggested that along these lines of planning the reaction, to get a physical effect produced as quickly as possible, was the intelligent way on which future processes must be developed.

Nuisance from Corrosive Fumes

Mr. W. A. DAMON (Chief Inspector under the Alkali Acts) referred to one aspect of superphosphate manufacture in which he is specially interested, viz., in dealing with the corrosive gases which were evolved. Mr. Packard touched on that in what he felt was a rather flippant manner; certainly he did not treat it with the reverence which it called for. Reference was also made in the paper to the bad conditions under which workmen used to labour in excavating the dens by hand before mechanical excavators were installed.

This class of work was brought within the scope of the Alkali Acts in 1881, and he imagined before then that not only the workmen, but also the neighbouring residents must have suffered because in his report for that year, the Chief Inspector at the time—he must have been Dr. Angus Smith—remarked that there were many superphosphate works where no means at all were adopted for scrubbing the gases which were evolved and the acidity of the escaping gases as quoted in that report was of the order of 0.6 to 0.7 grains per c. ft. He therefore had thought it would be interesting to see how this matter had developed between 1880 and the present time. The figures of acidity for the 10 year periods were as follows: up to 1890, 0.46 grains per c. ft.; 1900, 0.37; 1910, 0.23; 1920, 0.12; 1930, 0.07; and from 1930 to 1935 the figure was only 0.04 grain per c. ft. It was, therefore, gratifying to find that the manufacturers whilst developing the processes and increasing the plant so much, had still had regard to the amenities of their neighbours.

Mr. C. S. ROBINSON remarked that nobody seemed able to make any money out of the manufacture of superphosphate, and added that he said that advisedly because if he were going to make superphosphate he would not sell it, but would convert it into compounds and then put out an enormous amount of propaganda and create a lot of local goodwill and make profits in that way. The reason why money could not be made out of superphosphate was because the delivered cost ap-

proximated closely to the price which the farmer would pay, therefore, attention had to be focused on manufacturing costs. He had made a calculation that when a ton of superphosphate was delivered to a farmer it entailed the handling of about six tons of solids, which included the pyrites and burnt ore out of the acid works, the rock into the works and the rock at the grinding plant. Then the selling season was only two or three months in the year, and production was not continuous throughout the year so that the phosphate had to be put into store and stayed there for some months, after which it had to be taken out and bagged.

An Excessive Manufacturing Royalty

The chemist was influenced by the definition which the Minister of Agriculture gave to the word "solubility" and the method of prescribing the test of such things. In the present state of things it was necessary to sell material with a certain amount of calcium oxide in it and other bases to neutralise the acid, and there was a minimum amount of acid necessary to get the water solubility. Therefore, in his view there was very little chemistry in it, but mechanically there was a great deal. If he were correct about the six tons, it made all the difference to the balance sheet of a superphosphate company as to whether they were clever in handling these materials about the plant and appreciated that 1d. per ton at all these six stages made a difference in the net profit.

With regard to the Oberphos process, he had been given the task two or three years ago of examining that process for a firm in this country, and he saw the Oberphos people before Mr. Packard took it up and he was horrified to find that a royalty of 2s. per ton of superphosphate made by the process was asked for. His reply was that that amount of money was just not there. In a real up-to-date superphosphate factory a figure of 7s. to 8s. per ton should cover all manufacturing expenses from the reception of the rock and acid into the plant to bagging the final product and of that amount about 1s. 3d. was spent at what had been called the den. The only item that would be affected by the particular process was the 1s. 3d., and yet the Oberphos people were asking a royalty of 2s. per ton and at the same time tried to prove that with this royalty added the manufacturers would be saving money! It would be all right if the 2s. could be passed on to the farmer, but the farmer would not pay and it did not matter whether the stuff came from an Oberphos den, a Broadfield den, a Svenska den or any other den.

Mr. PACKARD replying to the discussion said that from Mr. Robinson's remarks it seemed that he had no real experience of the superphosphate trade. In the works they certainly did what Mr. Robinson had suggested, but when he spoke of the large cost of handling superphosphates in the factory, he felt that he himself could show Mr. Robinson a thing or two about that.

Research on Superphosphate

With regard to Mr. Parrish's remarks it was stated in the paper that there had not been sufficient research work done in the trade. Mr. Parrish's experience in the superphosphate trade would show him the reason for that. There had been in the past no money in it and none available for carrying out research work. If there had been a philanthropist who was prepared to put his hand in his pocket without hope of any profits and spend money over a period of years, it would no doubt have benefited the trade.

More recently some research work had been done and to some extent the trade was getting more or less on to the basis which Mr. Parrish was aiming at as an ideal. At the same time, he did not consider Mr. Parrish's suggestion of keeping superphosphate in the den for several days was a practical one. He could not visualise the factory which would turn out a large output on those lines. As Mr. Boyd had said, the question of getting the last traces of moisture out was a question of cost, and Mr. Parrish must give the trade credit for having considered that to some extent. In his view the cost of reducing moisture content from 8 per cent. to 4 per cent. was not justified by the expenditure which would have to be incurred. However, that was a matter of opinion. He felt that Mr. Parrish had not taken into account sufficiently his own experience and had not realised that owing to the policy of free imports into this country for a large number of years, the superphosphate trade here was practically bankrupt.

With regard to double superphosphate he had debated as to whether he should say anything about that in the paper, but he came to the conclusion that it was quite outside the orbit of ordinary superphosphate as it involved the manufacture of phosphoric acid, and he, therefore, decided to leave it out. It was not relevant to the subject of superphosphate.

With regard to Mr. Verschoyle's remarks, he did not see any reason why concrete should not be used in the construction of dens. In fact, in the Moritz-Standeart process the den was made of concrete and there was a toothed steel wheel in the concrete which gave it its circular motion. He did not think, however, there was sufficient experience yet to know whether there was any very great corrosive action. He knew of quite a number of ordinary hand dens in the old days which were constructed of concrete, and he did not think there was any reason why it should not be used now.

He assured Mr. Damon that he had not intended to speak flippantly in dealing with the toxic gases, because Mr. Damon had had occasion recently to complain of an escape of gases from one of his firm's factories. He had had no intention whatever of doing so, but if he had dealt with the subject at all it would have taken too long. Therefore, he had decided to deal with it as if it were not part and parcel of the process of making superphosphates, but as a subsidiary to it.

The Selection of a Filter Paper

By J. Barcham Green

IT is always difficult to make filter papers because the chemist requires a high speed of filtration and a clarity of filtrate, and the two things combine two totally different kinds of paper. In addition the paper should be strong when wet, but strengthened papers are always very slow in filtering so that you have a combination of qualities, which it is not practical to get in one paper. Therefore, it is a question of compromise.

Enumerable papers have been made to meet special demands. For scientific work in high speed Green's 704 is recommended, and for a very clear filtrate for accurate work Green's 702. Where large quantities are used price comes into it, and a reliable paper for this kind of work is Green's 401. It has a high speed and very clear filtrate. With regard to ash, in certain work it is vitally important to get the ash as low as possible, and for this Green's 802 is a remarkable paper. It has an ash of 11 cms. circle of 0.00022 gram, and the price is only 3s. 6d. per 100 circles. The same firm makes a faster paper, 801; and also a paper for very fine precipitates, 803.

It frequently happens that complaints are received from chemists about filter paper which they are using, and when investigated it is found that the wrong paper for that particular purpose has been used. J. Barcham Green and Son therefore suggest that when there is any trouble in filtration it is as well to consult a maker's catalogue, such as Green's List G, which contains a lot of interesting information.

With regard to strength, it is possible to make a paper with very great strength and the same speed of filtration, but they have to be made specially.

DR. JOHN HOWARD NORTHROP, of the Rockefeller Institute, Princeton, United States, has been awarded the Chandler medal of Columbia University in recognition of his discoveries concerning the constitution of protein and the chemistry of digestion. The Chandler medal was founded in 1910 in honour of Professor Charles Frederick Chandler, who taught at Columbia University and was one of the pioneers of industrial chemistry.

My Opinion of Present-Day Analytical Reagents

By C. H. MANLEY, M.A., F.I.C. (Leeds City Analyst)

THE analyst of to-day is forunate in having at his disposal a plentiful supply of high grade chemical reagents manufactured by British firms. To these firms he is now able to look for almost any reagent he requires, whereas formerly he had so often to depend upon foreign sources.

The "A.R." designation, used during and since the war and intended to indicate that any compound so described was of a special degree of purity, was, however, the monopoly of no firm in particular, with the result that compounds so described did not always come up to the standard intended by the Institute of Chemistry and the Society of Public Analysts. The joint issue in and since 1934 of analytical reagents under the registered name "Analar" by The British Drug Houses, Ltd., and Hopkins and Williams, Ltd., now guarantees that these reagents conform to certain standards set out in the book published by the two firms under the title of "Analar Standards for Laboratory Chemicals." As a result, the analyst can now rely, not only upon the purity of such comparatively easily prepared substances as the alkaline salts required for volumetric work, but also upon the purity of the sulphuric, nitric, and hydrochloric acids which play so important a part in the determinations of small amounts of arsenic and lead in various materials. He is therefore no longer in the position in which his predecessor was at the beginning of the present century, following the arsenic-in-beer scare of the year 1900. Then it was often found necessary first of all to eliminate arsenic present in the reagents before the requisite tests could be carried out. There was also the problem of preparing the arsenic-free zinc needed for the chemical Marsh test, and later for Gutzeit's test, as this gradually found favour. Along with this was the problem of countering the "passivity" to acids acquired by the purified zinc, and though these difficulties have been satisfactorily overcome, I, for one, fel that the granulated form of zinc is by no means the most satisfactory for the tests in question, many of the "granulations" being much too large to pass through the neck of the reaction flash. I personally favour the pellet form, which is free from the foregoing disadvantages, and to the manufacture of which perhaps more attention might well be paid.

The use of hydrogen peroxide as an oxidising agent in the estimation of small amounts of sulphur dioxide, present, for example, as bisulphite preservative in sausages, necessitates its possessing a low sulphuric acid content. Whilst, owing to the methods involved in the manufacture of hydrogen peroxide, it is difficult to effect the complete elimination of sulphuric acid, the purity nevertheless of the reagent now obtainable is such that, when used as a 10 volume solution, 20 c.c. of it will not require more than 0.1 c.c. of 0.1N.NaOH, as against the 4.0-4.5 c.c. that would be required for a sulphur dioxide content of 400-450 parts per million, when working with 32 grams of sample.

Prior to the colorimetric estimation of lead the employment of high grade potassium cyanide has been essential. The once familiar lump form which had to be reduced to powder, however, has now given way to a white crystalline powder, easily added to the solution under examination, either in the solid form, or as a freshly prepared solution, which is free from the yellow colour yielded by less pure brands.

Diphenyl-thio-carbazone (dithizone) in chloroform solution affords a very useful means of extracting lead from an ammoniacal solution, bismuth being the only other metal which is removable in this way. In the absence of bismuth, the method advocated by Allport and Skrimshire ("Analyst," 1932, *57*, 443), when applied to lead in urine, gives results in close agreement with those obtained by the Society of Public Analysts method ("Analyst," 1935, *60*, 541). We have yet, however, to discover a water soluble organic reagent, by means of which lead can be estimated colorimetrically. We are fortunate in having such a reagent for copper in sodium diethyl-dithio-carbamate, the yellow copper salt formed enabling very small amounts of the metal to be estimated, any iron originally present having first been removed. It may be copper in water conveyed to the consumer through a length a length of copper pipe, or it may be copper in green peas that requires estimation; the method is applicable to either case.

A very sensitive reagent now exists for the detection of nitrates in water in the shape of diphenyl-benzidine, which gives a dark blue ring when a nitrate-bearing water is floated on to its solution in sulphuric acid. This test has been applied in certain cases to the detection of added water in milk, the test being sensitive to 0.1 part per million. For waters containing 0.5 part or less of nitric nitrogen per million (e.g. municipal undertakings), however, at least 20 per cent. of added water is essential.

If space permitted, comment might be extended to include several reagents, which, like some of those already considered, are capable of estimating amounts of the order of 0.01 mgrm or less. Instead we will content ourselves with appraising the quality of present-day ether and petroleum ether, so much in demand as solvents for oils and fats; with stressing the continued dependability of such reagents as lead acetate, copper sulphate, and potassium iodide, all the while not forgetting the reliability of those numerous reagents, the purity of which is taken now almost for granted, but upon the good offices of which we count so much for the successful prosecution of our daily work.

By EDWARD RUSSELL, F.I.C. (Public Analyst for the County Borough of Bristol)

THE changes that have taken place in the laboratory reagents of the public analyst during the past 50 years are extremely extensive, and yet for those of us who commenced our scientific studies at that time there is a definite continuity of practice; for to such masters of laboratory technique as Vasey in London and Stoddart in the provinces, we are indebted to our appreciations of the necessity of the improved reagents, but who would have thought in 1887 that we should be enabled to buy at the present time a chemical with regard to which "limits of error" are fixed for common impurities. Laboratory reagents may be divided into three groups:—(1) Those chemicals which form the basis of the principal standard solutions; (2) Those whose aqueous solutions figure on the bench; (3) Those special reagents whose employment is associated with a specific process.

Left to himself the analyst was usually able to select the manufacturer who was endeavouring to emulate the standard of the German importer, but the word "pure" placed on a bottle of chemicals bought in England in the last century did not usually mean more than that it satisfied the standard of the B.P., 1898, for in the mind of the British manufacturer as in that of the British public, the distinction between the chemist and the pharmacist was but ill-defined. The standard solutions which I prepared in 1887 were based not on the impure Na_2CO_3 obtainable, but on the amount of H_2SO_4 estimated by weight in an H_2SO_4 standard; now the sulphuric acid may be standardised either by weight or volume as the sodium carbonate is of sufficent purity. Thus in substances of such basal necessity as Na_2CO_3 and iodine a new position has been acquired.

The good habit which commenced in the new century was further stimulated when the German importer was cut off by

war, and the use of reagents stamped as "A.R." became a recognised guarantee of purity, and it was no longer necessary to ask for the imported German chemical as in pre-war times, that their condition was in part met before the war may be instanced in regard to pure zinc, a special reagent of vital importance in toxicological inquiry which I was able to obtain. With our entry into the present decade the period of transition may be said to have passed, and the book published in 1934 by The British Drug Houses, Ltd., and Hopkins and Williams Ltd., records standards of purity of some 200 substances which is as Professor Thorpe says, "a valuable record of the chief properties of the substances with which it deals." With this book as a foundation there should be no difficulty in constructing a dictionary of standardised substances covering the three groups of laboratory reagents in general use, to which may be added the special organic reagents used in the detection and estimation of minute amounts of various metals.

By ARNOLD R. TANKARD, F.I.C. (City Analyst for Hull)

EVERY analyst and research worker now live in good times. There were no "good old times" so far as analytical reagents are concerned, for the old days were distinctly bad old days, when few chemicals could be relied on to conform to any rigid standard of purity, and workers had to purify for themselves all material used in important work—a procedure wasteful of time and material. All users will therefore acknowledge with gratitude the great improvements made in recent years in the manufacture of analytical chemicals, complying with definite and high standards of purity. And not only can all normal requirements be fulfilled by our British makers of these chemicals, but from experience one can say how helpful the manufacturers are when unusual material is required. Often a small special batch will be made on request, at such a cost that it is obvious the transaction cannot have been a financial gain to the maker.

The writer well remembers an experience of many years ago, when the mislabelling of a reagent bottle (the original label of the foreign maker) led to trouble, which fortunately in this case was of such a nature that it could readily be detected. An agar medium was found to remain fluid on cooling, though the agar alone set quite normally. Investigation showed that the "pure sodium chloride" used was really "sodium sulphite," which effectively destroyed the setting power of the agar. Such an "accident" is almost unheard of in these days of properly tested and guaranteed analytical reagents.

It can scarcely be gainsaid that formerly many of the variations found in the results of analyses by different workers were in some measure due to the impure chemicals used. Such variations in results have now been largely eliminated as a consequence of the improved quality of analytical chemicals.

As a war-emergency measure, when many fine chemicals became practically unobtainable in this country, the Society of Public Analysts and the Institute of Chemistry jointly issued a list of analytical reagents (A.R.) with specifications of purity for nearly 100 chemicals largely in demand. After the war was over, this list was much expanded by the manufacturers, and the modern lists of analytical chemicals of a high standard of purity, are the natural outcome of all this pioneer work. Over 200 analytical reagents of general use in many laboratories are now obtainable with a guaranteed specification on the labels, setting out the maximum amounts of the impurities most likely to be present. The provision of special chemicals for use in micro-analysis and "spot" tests, and of specific organic reagents for metallic radicles, are noteworthy advances of increasing value.

Limit tests in specifications for pure chemicals are not very satisfactory, and although these tests are still used in other spheres, they have fortunately been replaced by more definite specifications in the case of pure chemicals. For some special purposes, as in the accurate determination of minute amounts of heavy metals and of arsenic in foodstuffs and biological materials, it would be an additional help of great value if the worker had a definite figure of impurity instead of a maximum limit.

Until quite recently, the manner in which some of these pure chemicals were packed left much to be desired. The corks of the containers were usually of such a size that they fitted flush with the rim of the bottle neck. On removing this cork, it was no uncommon thing to find that pieces of cork and cork dust had contaminated the reagent, and frequently it was almost impossible to prevent it. A "bakelite" top for these corks is an improvement of recent origin, but even now dust from outside may settle on the ledge formed by the rim of the bottle neck, and this dust may find its way ultimately into the reagent unless great care is exercised. Some dust-proof design of the "bakelite" topped cork is indicated here; and in the case of many chemicals the "bakelite" screw-topped cap, without cork, is a desirable modification. Improvements on these lines should quickly come into universal use for pure chemicals.

It is very desirable, also, that attention should be given to the composition of the glass of the bottles intended to hold analytical reagents. It may be that makers are alive to the importance of this point; but since contamination of a chemical due to the presence of lead, arsenic, boron or other "impurity" in the glass may cause serious error in the work of analysts and research workers, they should be assured that no such contamination of an originally pure chemical is possible.

The writer wishes strongly to support the suggestion of Dr. G. Malcolm Dyson that labels for chemicals should be standardised, and that by a system of coloured labels chemicals and drugs be differentiated as coming within the Dangerous Drugs Acts, the Poisons Regulations (Schedule —), etc. It might be sufficient in many cases to place a small circular label of particular colour underneath the standard label, this small label to bear the letters "D.D.A.," or "P.R.(Sch.)."

By S. JUDD LEWIS, D.Sc., Ph.D., F.I.C.

THE analytical chemist has ever been grateful for the introduction of those specially pure chemicals commonly known as "analytical reagents," and for the progress made in this direction as his own demands have become more and more stringent.

At the present time these analytical reagents represent a decidedly high order of efficiency. Whether any one is really satisfactory or not depends largely upon the purpose for which it is required. This will always be so to some extent until 100 per cent. is actually attained. However, while awaiting that ideal there are a few things which may be improved; for example, there is no doubt that potassium hydrogen tartrate "A.R." is sufficiently pure for most purposes, but it is not always, probably not usually, adequate to serve as a secondary standard in making volumetric solutions, although that is recommended. It is, of course, fully understood that the salt must be dried before weighing, but that does not eliminate error caused by any other impurities which may be present.

One typical analysis refers to impurities amounting in the aggregate to 0.014 per cent. But each of these elements is combined with a corresponding ion, bringing the total impurities to something like 0.03 per cent., that is, about one

part in three thousand. No mention is made of other possible impurities, i.e., Na, NH_4, free tartaric acid, etc.; hence the need for further specification, which finds expression in the following experience.

Four grams of potassium hydrogen tartrate "A.R." was found to be equivalent to 21.63 c.c. alkali N/1; it was distinctly more acid to methyl orange than the following specimens. The same product after re-crystallisation required 21.33 c.c. An old sample, purified some years ago, 21.38 c.c., and another sample, purified by twice re-crystallising, 21.26. c.c. Clearly, the reputed standard required about 0.37 c.c. too much; in other words, a volumetric solution made to this standard would be in error by about 1.7 per cent. Without prosecuting details, it is evident that a reagent which may well be described as "A.R." for common purposes, may be quite unfitted for use as a volumetric standard.

This and similar cases raises the question, whether *any* "A.R." chemical as such is qualified to serve as a volumetric standard unless it is really 100 per cent., any more than it is fit to function as "As.T." It would be better to issue volumetric standard chemicals as such, labelled with advice as to what weight dried in the water-oven, or otherwise prepared, is equivalent to one gram.

A modern spectrum analysis will, of course, reveal impurities in practically all "A.R." chemicals, but there is neither call nor possibility to render substances used for ordinary chemical analysis "spectroscopically pure," but there are some salts which do not occupy so exalted a position as one might reasonably look for. As might be expected, the spectroscope reveals abundant calcium and strontium in "A.R." barium salts, but it is surprising to learn that one "A.R." specification puts the proportion so high as 0.2 per cent. "Ca + Sr" (elements) and in addition "alkalies and other metals" at 0.1 per cent., postulating a saline impurity of over 0.7 per cent. in a chemical which can be rendered very much purer by one or two extra recrystallisations. This reflects back on a recent experience where it was necessary to eliminate a large quantity of sulphate ion preparatory to the determination of a small quantity of calcium.

A field in which one must not be unduly critical in view of attendant difficulties, is the purity of mineral acids. The traces of iron and heavy metals are, *per se*, very small, but not infrequently they become significant when considerable amounts of these acids have to be boiled down over the substance under examination, whereby the concentration of the impurities is magnified a score or even one hundred times; their presence then becomes only too evident.

All considered, one must hold the average analytical reagents in high esteem for the majority of purposes to which they are applied, but there is unquestionably room for considerable improvement in several specific cases with a view to meeting certain common requirements.

Spectroscopic Control and Analytical Reagents

By C. J. D. GAIR, F.C.S., A.M.Inst. Gas E.

GLANCING through a small volume dealing with the standards of purity of certain analytical reagents the writer was struck by the quantity and complexity of the chemical work involved. Calcium carbonate, for instance, was found to have maximum allowable limits as follows:—Heavy metals (as Pb) 0.002 per cent., Fe 0.001 per cent., Mg 0.02 per cent., alkalis 0.1 per cent., and so on. This list as it stands does not appear particularly impressive, but when it is realised that every batch of the chemical has to be minutely examined, and that there are some 220 analytical reagents in all, the amount of work will be appreciated. Now it is a fact that such work keeps hundreds of chemists actively employed, and I would be the last to suggest any method which would tend to render their services unnecessary, but the experience of life is that the introduction of more direct chemical and physical control tends to increase rather than decrease employment, because much investigation has otherwise to be passed over on the grounds of economical working.

Fortunately, there is an analytical method whereby increased control can be exercised without undue cost. It is demonstrable that the modern spectrograph and spectrometer are of real value in this respect. Indeed, it goes further than that, for in the writer's own experience problems almost without solution by purely chemical means have been readily solved by one or other of these instruments. One such problem was mentioned by the author in THE CHEMICAL AGE, December 7, 1935, page 518. In that instance the presence or absence of small quantities (0.2 to 0.5 per cent.) of beryllia in refractories required confirmation. Chemical analysis would have meant nothing less than a research, but the spectrograph showed the Be doublet $\lambda\lambda$3131.1 and 3130.4 in a very short space of time (actually one hour). Had it been necessary for the beryllia to be estimated this could have been accomplished with equal facility by the same means. These things are matters of fact, not opinion, and instances could be multiplied indefinitely.

It is not difficult to find laboratories where the spectrograph is already making its presence felt. Dr. Judd Lewis, author of "Spectroscopy in Science and Industry," uses the instrument in general chemical analysis, and particularly in the preparation of his own highly purified analytical reagents. He thereby shortcuts many an involved chemical separation.

Little space is left for other examples, but attention can be directed to a work by Drs. Walther and Werner Gerlach. This is entitled "Clinical and Pathological Applications of Spectrum Analysis"; it was translated from the original German by Miss Joyce Twyman. On page 94 of this volume the following will be found "Examination of calcium salts. Honigschmid had to examine various calcium compounds of different origin to find whether the same proportion of Ca isotopes was present in all. Since *no impurities were discoverable by chemical means* a spectrographic analysis was made from the sparked solution. The result showed *all the samples to contain strontium.*" The quantities of strontium present were estimated spectrographically. Dr. Gerlack sums up the work thus: "By spectrographic tests it was possible to gauge the thoroughness of chemical methods of removing impurities—this is an application of spectrum analysis of which more use should be made."

Tested Analytical Reagents

Avoiding Contamination During Storage and Use

THE increasing demand for the analytical reagents suppied by J. W. Towers and Co., Ltd., of Widnes, indicates that the quality of these chemicals and method of packing is appreciated. It is of great convenience to the analyst to know the maximum amounts of impurities which the reagent is liable to contain, and Towers Tested Analytical Reagents are accordingly labelled with the guaranteed maximum limits of impurities. To avoid all risks of contamination by dust, cork fragments, etc., during storage and use, the reagents are packed into amber glass bottles fitted with non-metallic screw caps. As the cap fits outside the neck of the bottle, it is entirely dust-proof and will be found exceedingly convenient in use on the laboratory bench.

The Manufacture of Analytical Reagents

Some Considerations Revealed by the Laboratories of the General Chemical and Pharmaceutical Co., Ltd.

THE effect of specialisation on modern industrial production is obvious on all sides; nowhere, however, possibly, are its results of greater importance than in the chemical industry, and particularly in that branch concerned with the manufacture of analytical and other laboratory chemicals.

It is the aim of the reagent manufacturer to produce chemicals to as high a degree of purity as is economically possible. At the present time, with the heavy chemical industry, aided by the chemical engineer, continually improving the quality of its products or reducing its prices, the degree of purity attainable at a constant cost is continually rising over a wider range of products where fluctuations in the cost of raw material are proportionately small. To maintain this state, constant vigilance and forethought are required together with a readiness to abandon ideas, methods and plant, the moment they can be improved upon.

It is only a matter of efficiency which determines in any given case the maximum degree of purity which can be *economically* attained starting from a given set of raw materials; when that maximum has been attained only improvement in the raw materials or a change in the entire method of production can give a higher purity. An example will make this clear. The normal manner of producing a reagent "R" may be by the interaction of "A" and "B." Up to a certain time, the best results are obtained by reacting "A" and "B" as obtained from their separate processes, and then purifying "R" by recrystallisations, distillations, sublimations, or whatever method is best applied to "R." To continue our supposition let " A " be a very pure chemical, while " B," although as pure as has hitherto been economically attainable, is not so pure, and this fact has necessitated the further purification of " R " after production. At any time a change in the manufacture of " B " may result in a change in the composition of the impurities in " B " such that purification of " R " after manufacture does not produce as high a purity in the finished product for the same cost as does further purification of " B " before reacting with " A."

Another more common example is when " R " is a by-product from some other process, when the manufacturer must be alert to note the point at which the cost of purification of cheap grade " R " is greater than the cost of reacting " A " and " B " together or when the latter will give a purer product at a still economical cost.

In the manufacture of analytical reagents, everything which may affect the finished product must be very carefully considered before production is started. Firstly, the normal atmosphere in the neighbourhood of the plant needs consideration; if this is relatively clean and pure, it need not be further considered unless the plant itself is likely to vitiate it, when steps should be taken either to remove this possibility or to protect the actual process from its effects. In a large industrial area atmospheric purification must be relied upon. Secondly, the nature of all the appliances used, which come into contact with any of the materials or products must be considered from the point of view of contamination. In the same way, everything having any bearing on the process from start to finish must be taken into account.

During actual manufacture, it is essential that complete analytical control is maintained over the process at every possible point. The complete analyses of all raw materials and the required specification of the finished product are the yard-sticks against which the efficiency of each step in the process is measured. Each individual product has its own method of manufacture involving different methods of control; in one case the hydrogen iron concentration of the reaction mixture will have to be kept within very narrow limits from start to finish; in another case, it may, of necessity, be varied very greatly to facilitate the removal of certain impurities; and all these changes or otherwise must be constantly checked in the most rapid available manner in order to avoid delay in the process. The need for hydrogen-ion concentration control, is recognised and fairly widespread.

There are many other forms of control which have to be exercised, for example, concentration, speed of flow, speed of reaction, temperature, pressure, rate of evaporation, etc. Controls and checks which have for their object the attainment of the required degree are an obvious need in any properly organised industry; in the manufacture of reagents, however, there are called for additional controls on account of the fact that the physical form of the product may have to be varied according to the use to which it is to be put, or to the idiosyncrasies of particular users.

At the time of the final analysis of the product it is necessary not only to make sure that the quality is up to the standard demanded of himself by the particular manufacturer contcerned; special requirements of particular users must be taken into account. In this respect the fact that some of the specialised industries recently opened up in this country, employ Continental or American chemists, must be remembered. These workers are not used to English standards of purity, and in order that they can feel at home using chemicals manufactured in this country, it must be ascertained that the product is in conformity with the usual Continental and American standards. This last matter applies with even greater force when there is a probability of exporting the product to places abroad where any of these purity standards may be in common use.

Some Comments on Indicators for pH Determinations

A Contribution from the Research Organisation of Sofnol, Ltd.

THERE may be a certain reaction among chemists against a reagent sold under a fancy name as opposed to one which proclaims its composition in terms of systematic chemical nomenclature. In practice, however, there is often a good deal to be said for giving a standard reagent easily remembered trade name. This is certainly the case with the mixed indicators, known as Sofnol Purple and Sofnol Red. These indicators consist of combination of well-known indicator substances specially chosen to give a series of sharply defined colour changes at known *p*H values. Originally introduced to facilitate the delicate work of water analysis, they are now in general laboratory use—replacing the Methyl Orange and Phenol Phthaleïn on which so many of us were brought up, because they are far more sensitive to very dilute acids and alkalis and because they give sharp colour changes far nearer the true neutrality point (pH = 7) than is the case with the older indicators.

To get down to actual figures, it may be noted that Methyl Orange, for instance, changes colour at the *p*H value of 4 and is only sensitive to acids present in greater concentration

than one part in about 72,000. Moreover, as those with experience in the use of Methyl Orange well know, the colour change is gradual and one man's decision as to when the end point has been reached may not agree with another's. When, however, we use Sofnol Red we get a sharp colour change at *p*H 6.5—which is very near the true neutrality point—and the indicator will detect about one part of acid in 400,000 parts of water. The actual colour produced with acids is a purple red instead of an orange red, and this is in far greater contrast with the yellow colour produced with alkalis, making it very easy to determine the exact end point.

Sofnol Purple is a mixed indicator based upon the Sulphone Phthalëin series, and shows no less than four distinct colours at various *p*H values. Its changes from blue to green at *p*H 7.5 and from green to yellow at *p*H 6.7 are very near the point of true neutrality. It is also an extremely sensitive indicator, being capable of detecting one part of alkali in 1,000,000 parts of water. It is equally valuable for titrating from acid to alkali or from alkali to acid. In practice Sofnol Purple shows a purple colour with caustic alkalis, caustic alkaline earths and with the carbonates of potash and soda. With bicarbonate of potash or soda it is blue, with bicarbonate of lime or magnesia it is green and with acids it is yellow. Both Sofnol Red and Sofnol Purple are available commercially either in solid form or in solution, ready for use.

In addition to the special indicators mentioned above, the Sofnol Laboratories also produce Thymol Blue, Bromo Thymol Blue, Alpha Naphthol Phthalëin, Ortho Cresol Phthalëin, Diethyl Red, Methyl Red, Ethyl Orange, Methyl Orange, Phenol Phthalëin, and other indicators.

Another extremely useful reagent, which has already superseded older methods in most up-to-date laboratories, is Sofnolite. This is a solid reagent, which replaces potash solution for the quantitative absorption of acid gases. The messy business of filling and dealing with potash bulbs is well known to all those who have used this method, particularly in carbon determinations. In all such cases the substitution of a dry solid reagent which can be used in U-tubes is a great convenience. Actually, Sofnolite is a form of soda lime to which has been added a catalyst, the effect of which is not only to give it greatly increased absorptive capacity, but also to introduce an easily recognised colour change whereby the progress of a combustion and also the state of exhaustion of the particular tube in use can be seen at a glance. Sofnolite is a pale green granulated product and, as the carbon dioxide passes through it the colour changes through dark green and red to dull brown. As soon as the colour change stops advancing along the tube, you know that the reaction is complete, and time, oxygen and gas can be saved. It is hard to believe that anybody who has to carry out a number of routine analyses involving the quantitative absorption of CO_2, or other acid gases, and who has once tried this reagent could ever return to the old method.

It should be pointed out, perhaps, that unlike certain foreign reagents which have been introduced for similar purposes, British-made Sofnolite is quite reasonable in cost.

Another special Sofnol reagent to which reference should be made is a special soap for determining the hardness of water. The method has sometimes been regarded as rough and ready rather than exact, but investigation showed that highly consistent results could be obtained by selecting and standardising the soap used for the soap solution. Sofnol special soap keeps well and gives a sharp lathering point, increasing the accuracy of this well-known method. There are also various standard solutions supplied for the convenience of customers for the purpose of carying out routine water testing and other analytical work, the whole being described in a series of booklets obtainable on application to Sofnol, Ltd.

The Petroleum Industry

Adaptability to Rapid Economic Changes

THE adaptability of the petroleum industry to the rapid technical and economic changes which are so characteristic of our present civilisation, and the relation of the success of the industry to that flexibility was the subject of a lecture by Mr. J. Kewley, to the members of the Northern Branch of the Institution of Petroleum Technologists, at the Engineers' Club, Manchester, on January 20.

The enormous development of the motor car, said Mr. Kewley, would have been impossible without the great improvement in the efficiency of the refinery, which had been forced to turn its attention to methods of increasing the yield of gasoline from the crude. In the last 20 years the production of gasoline to crude had been more than doubled. The first and most obvious way of doing that was to reduce the volatility of the gasoline made, and so increase its yield from crude oil. That was effected by incorporating the lighter fractions of the kerosene; the reverse of what was being done before. At the same time they improved the fractionating capabilities of the plant.

In spite of those efforts it became obvious that something else had to be done to meet the ever increasing demand for gasoline, without unduly increasing the output of crude oil. Relief was effected in two main directions. One by the production of gasoline from natural gases, and the other by the cracking of the residuals, which for many years had been allowed to run to waste, or used as fuel on the fields. It was found that very volatile hydrocarbon gases, methane, pentane, etc., could be extracted, and these very volatile gasolines so obtained, could be incorporated into less volatile gasolines, so as to increase their volatility. This served to improve the lower volatility gasoline which was proving unsatisfactory to engine manufacturers.

In 1918 gasoline consisted of 85 per cent. straight run, 3 or 4 per cent. natural gasoline, and the remainder about 10 per cent. cracked. In 1936 straight run amounted to 40 per cent., with 52 to 53 per cent. cracked, and the balance natural gasoline. The result, of course, was that the yield of gasoline from the crude was very much greater than it was in early days. The yield of the gasoline in 1890 was 12 per cent. from the crude, and in 1936 it was 56 per cent. That was an excellent example of the way in which the petroleum industry was able to adapt itself to changing conditions, without upsetting its economy. Actually the anti-knock qualities of 2nd and 3rd grade petrol to-day were better than those of No. 1 grade petrol of five years ago.

A by-product of the cracking process was a hydrocarbon of the unsaturated type. Certain hydrocarbons might be of the required boiling range formed directly in the cracking process, and were put in the gasoline, but at the same time hydrocarbons of a lower molecular weight and very volatile were formed.

Another application of gasoline had been introduced by the rapid growth of aviation. Unfortunately, for the oil industry unsaturated hydrocarbons were not at all suitable for aviation purposes at the present time, mainly because of the difficulties of storage, as there was a tendency for unsaturated hydrocarbons to form gum, and as there were restrictions, technical and otherwise, on the use of tetra-ethyl-lead for increasing the anti-knock rating, the problem of producing saturated hydrocarbons of higher anti-knock value became of great importance. Great advances had been made in the hydrogenation plants now in commercial operation for the production of isomerides.

Two New Types of Indicators

Oxidation-Reduction and Absorption

TWO new types of indicator were described by Dr. A. D. Mitchell, F.I.C., University of London, at a joint meeting of the Society of Chemical Industry and Institute of Chemistry (Edinburgh and East of Scotland Section) in the North British Station Hotel, Edinburgh, on January 21, when Dr. David Bain, chairman of the local section of the Society of Chemical Industry, presided.

Remarking that everybody was aware of the existence of oxidation-reduction indicators and of adsorption indicators, Dr. Mitchell said that comparatively few people had tried them. Some of the methods he proposed to show, however, were of definite utility. Referring to oxidation-reduction indicators, he said that just as acidimetric indicators changed colour over a certain *p*H range, so these changed colour over a certain range of oxidation-reduction potential; and just as the former were weak acids or bases and owed their colour change to salt formation, so these indicators were weak oxidising or reducing agents (with respect to the titrated solution) and underwent a colour change on reduction or oxidation. The main differences between the two types was that one concerned that scission of H^+ ions and the other the scission of electrons. Another difference between the two was that the former were strictly reversible, whereas the latter were not strictly so in practice.

Pointing out that it was Knop's use of diphenylamine in the dichromate-iron titration in 1924 which provided the main stimulus to the work under review, Dr. Mitchell said that Knop could not use diphenylamine successfully until he added phosphoric acid to the solution. Later it was found that diphenylaminesulphonic acid gave a fairly accurate indication without addition of phosphoric acid, although the addition of this acid made the colour change more brilliant. Dr. Mitchell demonstrated the titration with sulphonic acid, and continued that the presence of mercuric chloride made the end-point less definite with diphenylamine, but not appreciably so with the sulphonic acid, so the method could be applied to solutions which had been reduced by stannous chloride. Thus one prevalent objection to this elegant method of reduction, that dichromate must be used and not permanganate, was removed, for the dichromate titration was now made simpler.

An Irreversible Ozidation

The oxidation of diphenylamine, which had long been used as a test for nitrate, proceeded through the stage of diphenylbenzidine, but the latter was not suitable in this titration, chiefly because it was less soluble than diphenylamine. Probably when it was formed as an intermediate stage *in situ*, it was in a supersaturated state. This oxidation was irreversible, but the stage giving rise to the coloured diphenylamine-blue was reversible. Dichromate alone did not oxidise this indicator, but the presence of ferrous ions facilitated the action. If phosphoric acids were present, ferric ions alone did not oxidise it. Unlike dichromate, permanganate oxidised diphenylamine directly in acid solution. With strongly acid or hot solutions there was further oxidation of these bases to golden compounds. The method was available for the titration of ferrous iron in presence of chromium, nickel, cobalt, manganese, zinc, tin, and, within limits, of mercury. The colour change was not masked.

Dr. Mitchell proceeded to state that it had not been possible to work out a valid theory of oxidation-reduction indicators as applied to inorganic work. If it ever became possible a fruitful field would be opened up. Until that time came they simply limited to hit or miss methods. Although they did know something of the oxidation-reduction intensities of the possible indicators, they did not know with sufficient accuracy in many cases the potentialities at which these agents changed colour.

Remarking that the titration of ferrocyanide by permanganate by the old method required some experience, because the orange colour due to the ferricyanide obscured the end-point, Dr. Mitchell said that by using diphenylamine it was possible to get a very sharp end-point. When the indicator was used with permanganate it was best to work in very dilute solution. A similar oxidation of ferrocyanide could be effected by ceric sulphate under similar conditions. Another titration which required a lot of experience under the old conditions was the titration of zinc by ferrocyanide. It used to involve a uranyl salt as external indicator and hot solutions. Now by an ingenious device the process was made amenable to oxidation-reduction indicator and was conducted in the cold.

Outlining some of the other methods based on these internal indicators, Dr. Mitchell illustrated two in which ceric sulphate was used as titrating liquid. Certain indicators of the triphenylmethanesulphonic acid type were of use with permanganate or ceric sulphate, he said, but their potentialities were too high for use with dichromate. Erio-green and erio-glaucine were two of this type which were widely used, but he preferred xylene cyanol FF. Dr. Mitchell mentioned that ceric sulphate was nearly as powerful an oxidising agent as permanganate and considerably stronger than dichromate. Also, its action involved only one valency stage as opposed to five with permanganate and there were consequently no intermediate stages to cause trouble. Ceric sulphate could also be used to titrate ferrous iron produced by stannous chloride reduction of ferric iron if not more than 5-10 cc. of conc. HCl had been used and if phosphoric acid was added.

A Plea for More Research

Concluding his remarks on oxidation-reduction indicators, Dr. Mitchell mentioned the recent employment of brucine as an indicator. He pointed out that it was available for ferrous solutions containing stannic and mercuric ions and so could be used if ferric iron had been reduced by stannous chloride. Also, it had recently been found useful for permanganate titration in presence of hydrochloric acid.

Dr. Mitchell illustrated his remarks on absorption indicators with several demonstrations, including the titration of bromide by silver, the titration of a chloride by silver, and the titration of bromide by mercurous nitrate in nitric acid solution, bromophenol-blue being the indicator. He emphasised that an important point was the extent to which the halide remained as a sol, for in this condition it absorbed something like 100 times as much dye as it would do in the coagulated form. In actual practice they got about one molecule of indicator per 1,000 molecules of halide. It could be varied within fairly wide limits, but too wide deviation from this ratio might lead to faulty results. Conditions were usually chosen so as to stabilise the sol as much as possible. If much sol was present, the titration was reversible.

Referring to titrations by silver nitrate, it was stated that for chloride they could use fluorescein, but it was not serviceable if they got down below about N/200; it was only valuable in strictly neutral solution. For bromides they could use fluorescein, but eosin was better. With practice eosin could be used in acid solutions, even nitric acids. It was a general rule that the stronger the dye acid the less its absorption was affected by hydrogen ions. For iodides it was better to use eosin, which gave very accurate results.

Dr. Mitchell concluded with a plea for more intensive chemical research. "Perhaps I may be allowed," he said, "to enter a plea for a more sympathetic and up-to-date attitude towards analysis and analytical research in our universities. Probably owing in part to the predominance of organic chemists, who send their samples and get their results by return of post, and who frankly scoff at analysis, the subject is under a cloud in Great Britain."

Coal and Allied Industries, Ltd.

An Offer for the Business and Assets Expected

A LARGELY attended extraordinary general meeting of Coal and Allied Industries, Ltd., was held at Winchester House, Old Broad Street, London, E.C.2. on Thursday, with Lord Eldon in the chair. It will be recalled that at the general meeting four weeks ago a resolution of the directors for the winding-up of the company was not passed, and an amendment appointing a committee of shareholders to investigate the affairs of the company was carried.

At Thursday's meeting Lord Eldon stated that the directors were informed that they might expect to receive shortly an offer for the purchase of the business and assets of the company. He was not in a position to give details except that the offer had been made by a group which, to the best of his knowledge, had had no connection with Coal and Allied Industries, Ltd., in the past. The offer was made conditional on acceptance within four weeks and approval by an extraordinary general meeting of the company. It involved payment in full of secured and unsecured creditors up to £55,000, and the provision of £250,000 in cash, from which £55,000 for the payment of creditors is to be deducted in arriving at the cash resources of the new company. This would be raised by the issue of 6 per cent. cumulative preference shares. Rather over one-third of the shares in the new company would be issued to the old company, and subject to the sum of £55,000 being sufficient to discharge the creditors of the old company, these shares would be available for distribution among present shareholders.

The directors were of the opinion that the offer was a favourable one, preserving as it did a one-third equity in the new company. It was not part of the arrangement that any directors of the present company should be appointed to the new board.

Mr. A. P. Godfrey, chairman of the Shareholders' Committee, then presented his report, at the conclusion of which he announced that the committee had had before them a proposition from a financial group. The negotiations were at such a stage that he could not make a fuller statement, but by Friday next week they would have a definite announcement on the matter.

Mr. Godfrey said the Committee had come to the conclusion that there were no grounds for asking for a Board of Trade Inquiry into the way in which the Company had been conducted.

Lord Eldon said this offer would be sent to the Shareholders' Committee. They would send it to the shareholders, who would receive three weeks notice in which to approve it.

Mr. Godfrey stated that both the receiver and bank manager to the company were sympathetic in their attitude and would prefer to see a satisfactory solution found.

Lord Eldon then declared the meeting closed.

Chemistry and Immunology

Phenomena in the Prevention of Disease

DR. M. STACEY, lecturer in chemistry at Birmingham University, delivered a lecture on "Chemistry and Immunology," at a joint meeting of the Society of Chemical Industry and the University Chemical Society at the University, Edgbaston, on Monday. He is going to the United States next week for three months to study the same subject at Columbia University.

In the course of this lecture Dr. Stacey reviewed the chemical investigations which had been made into the phenomena of immunity and in the prevention and cure of diseases caused by bacterial infections. He said a better word for immunology would be resistance. It was a process by which the organism defended itself against attacks of its enemies which were living micro-organisms. He described the experiments conducted both in this country and abroad into the reason why some people and not others are immune from various diseases, and also the endeavours made to obtain specific substances for immunisation, particularly against pneumonia and against food poisoning and diphtheria. In America large scale experiments in the injection of vaccines prepared chemically to protect against pneumonia had given conflicting results, but Dr. Stacey's view was that with further purification the factors at present detrimental might be removed. The results of the experiments at the London School of Hygiene, concentrating on food poisoning and typhoid organisms, were more hopeful. The lecturer also pointed out that considerable progress had been made in attempts to imitate artificially the course of natural immunisation. Attempts had been made to make synthetic substances which had a protective action, but so far this work had been limited to demonstration rather than giving protection against any particular disease.

Dr. Stacey asked how do the protective substances do their work. The answer at the moment was that they simply did not know. Various theories had been put forward, but there were objections to all of them. Further work would undoubtedly throw light on many of the complex problems of immunity, but rapid progress could only be made by team work and by co-operation between the chemist, the bacteriologist and the physiologist.

Dr. S. Peat, proposing a vote of thanks, said Dr. Stacey had been far too modest about his own work and skill on the subject.

Dr. D. W. Parkes, chairman of the Birmingham section of the Society of Chemical Industry, suggested that the time would come when the industrial chemist would be asked to produce the things of which the lecturer had spoken

Professor W. N. Haworth, head of the chemical department at Birmingham University, who presided, said it was evident from the address that the subject was gradually becoming one for the organic chemist. The subject was no longer a medical one, but was very largely a chemical one. Some progress had been made—at any rate preliminary progress—in showing what the substances were with which they had to deal, just as a clear way had been made for vitamins. In the near future they might see, he said, that active immunisation products might be available for specific diseases. That might be premature, but it appeared to be the direction in which work was going.

Letter to the Editor

Technical Data on Fuel

SIR,—After exceptionally heavy sales during the past few weeks, the whole of the first printing of the fourth edition of "Technical Data on Fuel," published in December, 1935—only just over a year ago—is now exhausted. The number printed was considerably larger than in the case of previous editions. There is a rapidly increasing sale in the United Stated and the book has been adopted by fuel technicians in the following countries, in addition to Great Britain and the United States:—Argentina, Australia, Brazil, Canada, China, Czechoslovakia, Denmark, Finland, France, Germany, India, Iran, Irish Free State, Italy, Japan, Jugoslavia, Netherlands, Netherlands East Indies, New Zealand, Norway, Russia, Spain, Sweden, Switzerland, Union of South Africa, and Uruguay.

It is proposed to print a second impression of the fourth edition, equal in number to the first impression, in preference to publishing a fifth edition at this stage. It is not anticipated that a new edition will be published before 1939. We wish to tender our apologies to intending purchasers of "Technical Data on Fuel" who will be temporarily unable to secure copies. The "fourth edition, second impression," will be placed on sale on about February 15.—Faithfully yours,

C. H. GRAY.

British National Committee,
World Power Conference.

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ROYAL Decree Law of October 15, 1936 establishes that the direct or indirect delivery and sale by the official sulphur sales office for Italian raw sulphur manipulating establishments in the Kingdom cannot exceed, save in exceptional cases, the average quantity which the sales office consigned to such establishments during the three years ended July 31, 1936.

THE principal use in Argentina for sodium arsenate is for the destruction of locusts. This work is conducted by the Argentine Ministry of Agriculture. The Ministry operates a small chemical plant near Buenos Aires where, among other things, sodium arsenate is produced.

Hydrogenation of Coal

Questions in the House of Commons

IN the House of Commons on January 19, Mr. G. Hardie asked the Secretary for Mines why alterations had to be made of the Bergius system of hydrogenation at Billingham, and if, after such alterations, the Bergius interests still held the patent rights over the parts altered or improved?

In reply, Captain Crookshank said he was advised that the Bergius system, apart from the basic principle of converting coal to oils by the addition of hydrogen, was insufficiently developed by its originators for practical commercial operation, for which purposes new apparatus and methods had to be devised. The Bergius patents involved had practically all either lapsed or been abandoned. The British Bergius Syndicate, which originally held limited options over the British rights, was wound up 12 months before the Billingham plant was initiated. Such rights as it held had been taken over by I.C.I. and were ultimately pooled with all that company's other rights resulting from their independent work, and with the rights in hydrogenation of their Continental and American associates who incidentally had become the controlling holders of the original Bergius rights.

Oil from Coal Statistics for Billingham

Mr. Hardie: Since the Government have given so much to Imperial Chemical Industries may I ask whether they hold any part of the rights in this new construction hydrogenation plant.

Captain Crookshank: I must ask the hon. member to put that question on the order paper.

Mr. Hardie then asked the Secretary for Mines (1) what number of tons of coal had been hydrogenated at Billingham; also the quantity of coal required to produce the hydrogen necessary for the treatment of one ton of coal; and the quantity of crude oil produced from the one ton treated; (2) the number of gallons of crude oil produced by hydrogenation at Billingham, based, not on the one ton treated, but upon the total amount of coal used in the treatment of one ton of coal.

In reply Captain Crookshank said he was not in a position to give information in the full detail, but by the courtesy of Imperial Chemical Industries, Ltd., he was able to furnish certain particulars concerning the working of the hydrogenation plant at Billingham in respect of 1936, the first complete calendar year of working.

These particulars were as follows:—

	Tons.
Petrol Production.	
Total Production of Refined Motor Spirit*	112,000 (about 33,600,000 gallons.)
Coal Consumption.	
Coal directly hydrogenated	100,000
Additional coal used for all other purposes—steam raising, power generation, hydrogen production, ancillary both to direct coal hydrogenation and also to tar hydrogenation (approx.)	325,000
Total usage of all coals (approx.)	425,000

* The process can be used to produce various final products. At present the plant is used entirely to produce motor spirit. Crude oil being only an intermediate product, figures of its production would have no real significance in view of the various modifications possible at intermediate stages.

Mr. Hardie: May I ask whether it is not the case that the plant at Billingham has not yet reduced any coal by hydrogenation to an oil state?

Captain Crookshank: That seems to be a very technical question of which I should like to have notice.

Mr. Louis Smith asked the Chancellor of the Exchequer what had been the approximate cost to the revenue of the Billingham hydrogenation plant since it was set us?

In reply the Chancellor of the Exchequer (Mr. Chamberlain) said he had no further informtion than that contained in the answer given to the member for Abertillery (Mr. Daggar) on December 15 last by the Secretary for Mines.

On January 21 Mr. L. Smith asked the Secretary for Mines the approximate tonnage and value of the hydrocarbon oils produced by the Billingham hydrogenation plant at world-market prices; and what had been the approximate tonnage and value of the coal purchased for processing.

In reply Dr. Burgin said as regards the tonnage of hydrocarbon oils produced and the tonnage of coal used at the hydrogenation plant at Billingham during the year 1936, he must refer this question to the reply given on January 19 to two questions by the member for the Springburn Division of Glasgow (Mr. Hardie). He was not able to supply the rest of the information asked for.

The Freeman Process for Oil from Coal

Mr. Edwards then asked the Lord President of the Council what were the results of the tests made by the fuel research station into the Freeman process of extracting oil from coal?

In reply Mr. R. MacDonald said that under its published scheme, the Department of Scientific and Industrial Research conducted extended tests from June, 1925, until the dismantling of the plant in November, 1925, upon a Freeman multiple retort belonging to British Oil and Fuel Conservation, Ltd. The report was published in 1926. He would like to take this opportunity to say that in March of last year, the directors of Coal-Oil Development (Great Britain), Ltd., accorded facilities to officers of the Department to witness a demonstration of their apparatus employing the Freeman process. The apparatus at present, however, was only on a laboratory scale, which did not permit of a test being made within the scope of the Department's published scheme. No question of publication of a report therefore arose.

Scientific Apparatus and Supplies

A New Catalogue

TOWNSON AND MERCER, LTD., stated business as chemists and developed as scientific manufacturers and chemical dealers at Bishopsgate, near the "Olde Watch House" within the City of London, in 1798. Their premises are now situated nearby at 34 Camomile Street, and they have works at Croydon, Surrey. They specialise in all equipment and furnishings for laboratories, as well as pure chemicals for analysis, research, and manufacturing processes. The 1937 edition of their universal catalogue is in the press. Comprising about 1,350 pages, it will give full details of the latest standard patterns of apparatus for technique in assaying, bacteriology, botany, ehcmistry, clinical diagnosis, entomology, metallurgy, meteorology, mineralogy, pathology, physiology, and general analytical research work. Most of the articles supplied are of British manufacture. Laboratory fittings are detailed in sectional lists, such as apparatus for testing oils, "Apparatus for testing oils, tars, etc." Fittings of special interest include "Camac" laboratory taps of a new design, gas analysis apparatus, and standard interchangeable glass joints and fittings which are now used for research work and are found much more satisfactory than the old patterns connected with rubber corks.

THE new price list of "Postlip" filterings has been considerably enlarged, as Evans, Adlard and Co., Ltd., are now making more types of filtering paper. Users of filter paper are advised to obtain a copy of this price list with which there are representative samples of the filterings in pockets attached to the cover of the list.

Personal Notes

MR. ROBERT EDWARD GATENBY, of Wilmslow, Cheshire, soap manufacturer, left £47,405, with net personalty £45,915.

MR. GEORGE M. HOBBS, of Wallasey, Cheshire, chief assistant at the Liverpool shipping office of Imperial Chemical Industries, Ltd., left estate to the value of £1,087, with net personalty £328.

MR. W. A. WARD, lately with Simon Carves and Co., Ltd., Manchester, as chief engineer of their boiler department, has joined the board of Bennis Combustion, Ltd., to which company he will act as general manager.

COUNCILLOR A. E. BRUNNING, of Lincoln, was presented with an inscribed silver cigarette case during a sales conference of Doughty-Richardson Fertilisers, Ltd., and associated companies, in recognition of his long service with the company.

MR. THOMAS ROBERTS, Junction Road, Bolton, manufacturing chemist, founder and former head of Roberts Coupline, Ltd., and Roberts Patent Filling Machine Co., who died on October 14, left estate of the value of £112,222, with net personalty £101,651.

MR. JOHN AMOS and MR. J. RAWSTHORN, two old employees of Charles Ainsworth and Co., Ltd., dyers, Bury, Lancashire, were the recipients of presentations at a dinner and social on January 16. Colonel C. Ainsworth, managing director, presided and Mr. C. M. Ainsworth, Mr. A. H. Ainsworth, and Mr. H. Schofield, directors, were also present. In making the presentations Colonel Ainsworth referred to the long service the recipients had given to the firm, Mr. Amos 38 years, and Mr. Rawsthorn nearly as long. Mr. Amos was the first man engaged by the firm. The gifts consisted of Westminster chimes timepieces, and the inscriptions stated that they were from the directors and workmen of Charles Ainsworth and Co., Ltd., 1898-1936.

MR. W. A. C. CHRYSTAL and MR. H. C. FAIRLIE have been appointed to the directorate of John and James White, Ltd., chemical manufacturers, Glasgow.

MR. L. HORE BELISHA, Minister of Transport, has promised to be the principal guest at the annual luncheon of the Commercial Motor Users' Association at the Savoy Hotel, London, on April 7, and to respond to the toast of His Majesty's Ministers.

MR. HAROLD P. GREENWALD has been appointed supervising engineer of the Pittsburgh Experiment Station of the United States Bureau of Mines in succession to Mr. W. P. Yant, who recently resigned to accept an executive position with an industrial concern. Mr. Greenwald has been in the service of the Bureau of Mines since 1914.

MR. ROBERT C. MCGILCHRIST, for the last 12 years cashier at the Ardeer Factory of Imperial Chemical Industries, Ltd., has died. He joined Nobel's Explosives Co., Ltd., at Ardeer, in 1890, when 12 years of age, and had the longest record of service at the factory when he died. He was 58 years of age and leaves a widow, two sons, and two daughters.

PROFESSOR W. L. BRAGG, Longworthy Professor of Physics at Victoria University, Manchester, has promised to give a course of three special London University lectures on "The Structure of Alloys" at the Imperial College, South Kensington, on February 15, 17 and 18. The lectures are intended for students of the University and others interested in the subject, and admission will be free, without ticket.

DR. D. P. MORGAN has been elected chairman for 1937 of the New York Section of the American Chemical Society in succession to Dr. Lawrence W. Bass, who recently joined the staff of the Mellon Institute of Industrial Research. Dr. Duncan A. MacInnes, of the Rockefeller Institute, was chosen vice-chairman; Dr. Cornelia T. Snell, of New York, secretary; and D. R. deLong, of the Amusol Corporation, treasurer.

Chemical Notes from Foreign Sources

Hungary

THE CONTROLLING INTEREST in Klotild First Hungarian Chemicals, Ltd., has been acquired by the Salgotarjan Steel Works, which already controls other chemical manufacturers.

Belgium

SYNTHETIC MOTOR SPIRIT IS TO BE MANUFACTURED by the Société Belge de l'Azote without the aid of a State subsidy, operating a process entirely independent of foreign patents.

TANTALUM AND NIOBIUM ARE NOW BEING PRODUCED in the Belgian Congo by the Géomines concern of Brussels, using cassiterite from the Manona Mines as raw material.

Russia

PLANT FOR MAKING SODIUM FLUOSILICATE has been installed as an experiment in the Newski factory. Further factories will be equipped for the manufacture of fluorine products during 1937. The Konstantinowka factory is to produce barium fluosilicate.

Czechoslovakia

A SULPHURIC ACID FACTORY of the most modern type has just been started up at Sillein by the Ossig Union for Chemical and Metallurgical Production.

THE PROBLEM OF SOAP GRADE STANDARDISATION has been engaging the attention of Czechoslovakian soap manufacturers for some considerable time. Apart from defining the composition of curd soap, soft soap and special brands of soap an attempt is being made to reach uniformity on such points as the type of packing and weight of tablets.

Poland

MANUFACTURE OF TWO DYESTUFFS INTERMEDIATES, naphthyl aminosulphonic acid and 2, 5, 7-aminonaphthol sulphonic acid, has been commenced by the Boruta Co., of Zgierz, on a scale adequate for home requirements.

Japan

INCREASED GLYCERINE PRODUCTION IS FORECAST for this year. Of the previous year's production of about 8,000 metric tons, 43 per cent. was used for dynamite and other explosives, 22 per cent. for medicinal purposes, 13 per cent. for cosmetics and 22 per cent. for tobacco manufacture and other industrial purposes.

Jugoslavia

TO ENLARGE ITS OIL AND FAT PRODUCING PLANT, the Astra Co., which is a subsidiary of the Phœnix Oil and Transport Co., Ltd., of London, has increased its share capital from six to ten million dinars (equivalent to £46,200). Part of the extra capital will be used to develop the sales organisation for naphtha products.

Germany

THE DEUTSCHE GOLD-UND SILBER-SCHEIDEANSTALT announce a dividend of 9 per cent. (unchanged) for the year ending September 30 last. Satisfactory trading activity of the numerous subsidiary concerns is recorded, these including G. Siebert G.m.b.H., of Hanau, Holzverkohlungs-Industrie G.m.b.H., Atlas Ago Chem. Fabrik A.G., of Mölkau, and the Degea A.G. (Auergesellschaft), of Berlin.

From Week to Week

THE ANGLOVAAL PORTLAND CEMENT CO., LTD., have changed their name to Anglo-Alpha Cement, Ltd.

THE SHETTLESTON OIL AND CHEMICAL CO., LTD., Glasgow, E.2, has been admitted to membership of the Glasgow Chamber of Commerce.

THE SECOND ANNUAL STAFF DANCE of the National Fire Protection Co., Ltd., will be held at the Castle Hotel, Richmond, on February 11.

THE FALCON CHEMICAL AND RUBBER CO., Radcliffe, Lancashire, has established a branch at Little Lever, near Bolton, where the firm has taken premises in Church Street.

THE ZINC CORPORATION announces that difficulties have arisen in connection with a section of underground workers which is adversely affecting mine output. Efforts to adjust difficulties so far have been unsuccessful.

AN AGREEMENT WHEREBY GERMANY WILL DOUBLE her imports of Roumanian oil is reported to have been reached between the two countries. In exchange, Roumania will take an increased quantity of oil-well machinery from Germany.

THE VESTFOLD WHALING CO. announces that its catch from December 8 to January 17, was 48,000 barrels of whale oil. The catch of the Viking Whaling Co. over the same period was 32 000 barrels of whale oil.

THE IDEAL HOME EXHIBITION, which attains its coming-of-age this year, will be held at Olympia from March 30 to April 24. Coronation fashions will be the outstanding theme of the exhibition.

THE TWENTY-FIFTH ANNUAL DINNER of the Finsbury Technical College Old Students' Association, will take place at the Trocadero on February 13. Applications for tickets, with remittances, should be sent to the hon. secretary, Mr. F. R. C. Rouse, 15 Clifton Gardens, Golders Green, N.W.11.

THE DANGER OF SECRET MILK MANUFACTURING AND MARKETING PROCESSES getting into the hands of competitors by reason of inspections by Marketing Board officials was mentioned on January 26, at the resumption, in London, of the public inquiry into the milk products marketing scheme.

THE ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA, LTD., has announced its intention to produce aluminium at its treatment plant at Risdon, Tasmania. The company will be the first to exploit this metal in Australia. Imports of aluminium to Australia in the year ended June 30, were valued at £250,000 in Australian currency.

GENERAL REFRACTORIES, LTD. are moving their registered office to Russell House, Adam Street, London, W.C.2, and the registration department and share transfer office will, as from February 1, 1937, be at that address. The registrar will be Mr. G. L. Morris. Stockbrokers are requested to deliver transfers to the above address instead of sending them to Sheffield as hitherto.

WHEN THE BRITISH PHARMACOPOEIA FOR 1932 was issued, the British Drug Houses, Ltd., published a guide directing attention to many important innovations. The response accorded this guide by pharmacists has led B.D.H. to assume that a guide to the recently-published Addendum 1936 to the B.P.1932, would be welcomed. A copy of the new guide is now available to any pharmacist who cares to apply for it.

STOCKHOLDERS OF IMPERIAL CHEMICAL INDUSTRIES, LTD., are requested to send certificates for deferred shares to the company, Imperial Chemical House, Milbank, London, S.W.1, on and after February 1, to be exchanged for certificates for ordinary stock. Under the scheme of reconstruction sanctioned last year, after long litigation, the £10,868,282 deferred stock (formerly 21,736,564 deferred shares of 10s.) was converted into £5,434,141 ordinary stock.

THE COUNCIL of the Mineralogical Society has decided to dispose of the Society's library, retaining only sets of certain important mineralogical periodicals. Some books and periodicals required by the Geological Society of London have been given to that Society, and 506 separates have been presented to the Mineral Department of the British Museum. The council has decided that the remainder of the library shall be offered for sale in the first place to members.

THERE WILL BE FIVE Royal tours of the British Industries Fair which opens on February 15. The King will pay two visits and Queen Elizabeth and Queen Mary will each make three. Queen Elizabeth will be at the White City on the opening afternoon. Next day the King, the Queen and Queen Mary all go to Olympia together during the morning, the first occasion in the history of the Fair on which a King and two Queens have visited it at the same time. On the Wednesday the King and Queen Mary make separate tours of the White City, the King in the morning and Queen Mary in the afternoon. Both Queens go to Olympia together on the Thursday morning.

PROSPECTING LICENCES AFFECTING TWO LARGE AREAS in Yorkshire, Lancashire, Derbyshire and Cheshire, have been granted under the Petroleum (Production) Act, 1934, to Steel Bros. and Co., Ltd., of 6 Fenchurch Avenue, London, E.C.3, states the "London Gazette." Particulars of the situation and boundaries of the licensed areas are published, and a map showing the areas for which licences have been issued can be inspected on application to the Petroleum Department, Mines Department, Dean Stanley Street, London, S.W.1. One of the areas covers approximately 173 square miles in Yorkshire, Derbyshire, and Cheshire. The second area is approximately 177 miles, in Yorkshire, Lancashire and Cheshire.

THE LESS-KNOWN CONSTITUENTS of milk and their examination will be discussed at a joint meeting of the Society of Public Analysts and the Food Group of the Society of Chemical Industry at Burlington House, London, next Wednesday. The following papers will be presented: First session, 5.15 p.m., "Some Minor Component Acids in Milk-Fat and their Possible Significance," by Professor T. P. Hilditch; "Present Knowledge of the Amylase in Milk," by Dr. L. H. Lampitt and Mr. A. T. S. Babb; "The Oxidation-Reduction Systems in Milk," by Mr. R. T. S. Twigg. Second session, 8.15 p.m., "Some Recent Work on the Lipase and Phosphates of Cow's Milk," by Professor H. D. Kay, Dr. E. C. V. Mattick, and Dr. S. J. Folley; "Recent Knowledge of the Minor Nitrogenous Constituents of Milk," by Dr. J. H. Bushill, Dr. L. H. Lampitt, and Mr. D. F. Filmer; and "The Estimation of Catalase in Milk," by Mr. E. B. Anderson and Dr. R. MacWalter.

A CONJOINT CONFERENCE on atmospheric corrosion arranged by the Liverpool and Manchester sections of the Society of Chemical Industry and the Chemical Engineering Group will be held at Manchester next Friday, February 5. Two sessions have been arranged, one at 10.30 a.m., when Dr. W. H. J. Vernon, of the Chemical Research Laboratory, Teddington, will read a paper on "Atmospheric Corrosion of Metals," and one at 5.45 p.m., when two papers will be read: (a) "Field Tests on Ferrous and Non-Ferrous Materials," by Dr. J. C. Hudson, of the corrosion committee of the British Iron and Steel Federation; and (b) "Practical Observations on Atmospheric Corrosion of Non-Ferrous Materials," by Mr. E. A. G. Liddiard, of the British Non-Ferrous Metals Research Association. After the morning session the members will visit the works of the Lancashire Steel Corporation at Irlam, where they will be entertained to luncheon. The evening session will be followed by a dinner at the Manchester Constitutional Club.

THE IMPROVEMENT SHOWN IN THE BOARD OF TRADE RESURNS is strikingly reflected in the china clay industry, particularly with regard to china clay. With the aggregate turnover of the past year it is quite evident that the china clay industry is gradually regaining its former prosperity. It is also gratifying to learn that the ball clay trade is progressing. This is probably owing to the demand for the Coronation commemorative ware, but it is evident that the restriction on foreign exports is a factor in the increased trade. Details of the December shipments are as follows:—Fowey, 49,442 tons china clay; 3,619 tons china stone; 1,953 tons ball clay. Par, 8,377 tons china clay; 354 tons china stone. Charlestown, 3,750 tons china clay; 236 tons china stone. Padstow, 850 tons china clay. Plymouth, 113 tons china clay. Newham, 87 tons china clay. Rail, 6,536 tons china clay, aggregating a total tonnage of china clay, 69,155 tons; china stone, 4,209 tons; ball clay, 1,953 tons. The total shipments for 1936 were 844,375 tons compared with 770,710 tons in 1935, and 754,768 tons in 1934.

Latest Oil Prices

LONDON, Jan. 27.—LINSEED OIL was firm. Spot, £29 5s. per ton; (small quantities) Feb., £26 15s.; March-April and May-Aug., £26 17s. 6d.; Sept.-Dec., £27, naked. SOYA BEAN OIL was steady. Oriental (bulk), afloat, Rotterdam, £29 10s. per ton. RAPE OIL was quiet. Crude extracted, £35 10s. per ton; technical refined, £36 10s., naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £31 per ton; refined common edible, £35; deodorised, £37, naked, ex mill (small lots £1 10s. extra). TURPENTINE was inactive. American, spot, 42s. 9d. per cwt.

HULL.—LINSEED OIL, spot, quoted £26 15s. per ton; Jan. and Feb.-April, £26 10s.; May-Aug., £26 12s. 6d.; Sept.-Dec., £26 17s. 6d. COTTON OIL, Egyptian, crude, spot, £30 10s.; edible, refined, spot, £33 10s.; technical, spot, £33 10s.; deodorised, £35 10s., naked. PALM KERNEL OIL, crude, f.m.q., spot, £36, naked. GROUNDNUT OIL, extracted, spot, £34 10s.; deodorised, £37 10s. RAPE OIL, extracted, spot, £34 10s.; refined, £35 10s. SOYA OIL, extracted, spot, £34; deodorised £36 per ton. COD OIL, f.o.r or f.a.s., 27s. 6d. per cwt. in barrels. CASTOR OIL, pharmaceutical, 45s.; first, 40s.; second, 38s. TURPENTINE, American, spot, 44s. per cwt.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

PROCESSES AND MEANS FOR PREVENTING THE COAGULATION OF VARIOUS SUBSTANCES.—Electric Smelting and Aluminium Co. July 16, 1935. 23685/35.

PRODUCTION OF COLLOIDAL DETERGENTS.—Electric Smelting and Aluminium Co. July 12, 1935. 24287/35.

MANUFACTURE OF PHOTOGRAPHIC SILVER HALIDE EMULSION LAYERS. I. G. Farbenindustrie. July 16, 1935. 16331/36.

MANUFACTURE OF ARTIFICIAL MATERIALS from halogenated hydrocarbons.—I. G. Farbenindustrie. July 17, 1935. 18245/36.

PROCESS FOR THE PRODUCTION OF OLEFINES by catalytic dehydrogenation of paraffin hydrocarbons.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 15, 1935. 18417/36.

MANUFACTURE OF METALLIFEROUS AZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. July 12, 1935. 19376/36.

MANUFACTURE OF GLUCOSIDES having an action on the heart.—I. G. Farbenindustrie. July 12, 1935. 19379/36.

PROCESS FOR THE MANUFACTURE OF UNSATURATED NEUTRAL OXIDATION PRODUCTS of stigmasterol compounds.—Schering-Kahlbaum, A.-G. July 13, 1935. 19456/36.

MANUFACTURE OF ORGANIC ACIDS and esters.—E. I. du Pont de Nemours and Co. July 13, 1935. 19467/36.

TREATMENT OF CELLULOSE NITRATE.—E. I. du Pont de Nemours and Co. July 13, 1935. 19465/36.

PROCESSES FOR THE MANUFACTURE OF BUTYL ALCOHOL from ethyl alcohol.—Deutsche Gold-Und Silber-Scheideanstalt Vorm. Roessler. July 13, 1935. 19467/36.

PROCESS FOR THE PURIFICATION OF SYNTHETIC CAMPHOR.—Montecatini, Soc. Generale Per L'Industria Mineraria and Agricola. July 15, 1935. 19647/36.

MANUFACTURE OF INDIGOID DYESTUFFS.—Soc. of Chemical Industry in Basle. July 15, 1935. 19650/36.

PRODUCTION OF PLASTIC MASSES from organic colloids.—I. G. Farbenindustrie. July 17, 1935. 19874/36.

MANUFACTURE OF VAT DYESTUFFS.—I. G. Farbenindustrie. July 17, 1935. 19895/36.

MANUFACTURE OF STEROL DERIVATIVES.—I. G. Farbenindustrie. July 18, 1935. 20058/36.

Specifications Accepted with Date of Application

PROCESS FOR IMPROVING ROSIN.—L. Mellersh-Jackson (Columbia Naval Stores Co. of Delaware). October 21, 1935. 459,320.

PRODUCTION OF CHEMICALLY RESISTANT OIL COLOUR PAINTS.—G. Ruth, A.-G. January 9, 1935. 459,257.

MANUFACTURE OF VAT-DYESTUFFS and intermediate products therefor.—Soc. of Chemical Industry in Basle. February 4, 1935. 459,333.

MANUFACTURE OF COLOURED MASSES FROM CELLULOSE DERIVATIVES, natural or artificial resins, or waxes.—Soc. of Chemical Industry in Basle. February 6, 1935. 459,334.

DESULPHURISATION OF GASES.—Sulfur-Chemie, A.-G. March 25, 1935. 459,418.

PROCESS FOR THE MANUFACTURE OF VITAMIN PREPARATIONS.—Nyegaard and Co. Aktieselskapet. February 11, 1936. 459,467.

PREPARATION OF STEEL PICKLING INHIBITORS.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 3, 1935. 459,420.

MANUFACTURE OF DIAZOAMINO COMPOUNDS.—Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies Etablissements Kuhlmann. April 20, 1935. 459,342.

RECOVERY OF HYDROCARBONS from gases containing the same.—I. G. Farbenindustrie. April 20, 1935. 459,471.

PROCESS FOR INCREASING SLIP IN STRUCTURELESS FOILS composed of highly polymeric materials.—Wolff and Co. Kommandit-Ges. Auf Aktien. May 23, 1935. 459,344.

BASE-EXCHANGING MATERIAL for bringing about ion exchanges.—S. Moller. March 16, 1936. 459,286.

PROCESS FOR STABILISING LEAD TETRAETHYL and anti-knock mixtures containing same.—I. G. Farbenindustrie. October 24, 1935. 459,270.

PROCESS FOR THE MANUFACTURE OF DERIVATIVES of 2, 4-dioxo tetrahydro-pyridine.—F. Hoffman-La Roche and Co., A.-G. August 28, 1935. 459,488.

PURIFICATION OF LIQUIDS.—Dorr Co., Inc. March 29, 1934. 459,288.

REFINING OF HYDROCARBON LIQUIDS.—Burmah Oil Co., Ltd., and B. C. Allibone (H. L. Allan (in part)). April 9, 1935. 459,595.

MANUFACTURE OF SOLUTIONS of polymerisation products.—W. W. Groves (I. G. Farbenindustrie.) April 9, 1935. 459,596.

PRODUCTION OF AQUEOUS DISPERSIONS of nitrocellulose.—C. R. N. Strouts, and Imperial Chemical Industries, Ltd. June 12, 1935. 459,850.

Applications for Patents

(January 7 to 13 inclusive.)

MANUFACTURE OF ZINC OXIDE.—G. Antonoff. 966.

RECOVERY OF PHENOLS.—Bakelite, Ltd. 713.

MANUFACTURE OF CARBON BLACK.—Bayerische Stickstoffwerke A.-G. (Germany, Jan. 9, '36.) 836.

FORMING FILMS OF SYNTHETIC RESIN.—H. Bieuville. (France, Jan. 7, '36.) 533.

ROASTING MATERIALS RICH IN SULPHUR.—N. S. Borch. 657.

MANUFACTURE OF MAGNESIUM SULPHATE, ETC.—W. Brothers. 738.

MANUFACTURE OF AZO DYESTUFFS of the anthraquinone series.—A. Carpmael (I. G. Farbenindustrie.) 716.

MANUFACTURE OF NITRO DYESTUFFS.—A. Carpmael (I. G. Farbenindustrie.) 717, 813.

MANUFACTURE OF ACID-WOOL DYESTUFFS.—A. Carpmael (I. G. Farbenindustrie.) 718.

WETTING AGENTS FOR STRONG ALKALI DYES.—Chemical Works, formerly Sandoz. (Switzerland, Jan. 9, '36.) 636.

DECOLORISING CELLULOSE MATERIAL.—P. Colemann. 534.

BITUMINOUS COMPOSITIONS.—T. W. Ward, Ltd., and A. P. Booth. (Aug. 1, '35.) 468.

BITUMINOUS COMPOSITIONS.—T. W. Ward, Ltd., and A. P. Booth. 469.

APPARATUS FOR CRYSTALLISING SOLUTIONS.—N. V. Werkspoor. (Holland, Jan. 11, '36.) 507.

EXTRACTING METALLIC ALUMINIUM from its ores, etc. T. Wood. 569.

REINFORCEMENT OF SYNTHETIC RESINOUS MATERIALS, ETC.—De Havilland Aircraft Co., Ltd., Aero-Research, Ltd., and N. A. de Bruyne. 629.

MANUFACTURE OF CONDENSATION PRODUCTS.—W. Dobke, and F. Kiel. (Germany, Jan. 13, '36.) 1086.

SEPARATION OF LIQUIDS FROM SOLIDS.—N. V. Dorr-Oliver. 586.

MANUFACTURE OF ARTIFICIAL MATERIALS.—H. Dreyfus. 517.

TREATMENT OF HYDROCARBON OILS.—H. Dreyfus. (July 25, '36.) 1043.

TREATMENT OF HYDROCARBONS.—H. Dreyfus. 1047.

RESINOUS CONDENSATION PRODUCTS.—E. I. du Pont de Nemours and Co. (United States, Jan. 7, '36.) 545.

COATING-COMPOSITIONS.—E. I. du Pont de Nemours and Co. 862.

POLISHING-COMPOSITIONS.—E. I. du Pont de Nemours and Co. 863.

REMOVAL, ETC., OF ACIDIC GASES.—R. B. Evans. 658.

PROCESS FOR SEPARATING ACETYLENE from mixtures with ethylene and ethane.—Ges. für Linde's Eismaschinen, A.-G. (Germany, Jan. 11, '36.) 831.

PRODUCTION OF OIL FROM COAL.—A. T. du Valon-Green. 935.

MANUFACTURE OF SILVER HALIDE EMULSIONS.—W. W. Groves (I. G. Farbenindustrie.) 600, 601.

MANUFACTURE OF GLUCOSIDES, ETC.—W. W. Groves (I. G. Farbenindustrie.) 692.

MANUFACTURE OF CHROMIUM OXIDES, ETC.—W. Hene. 544.

Chemical and Allied Stocks and Shares

MOST sections of the Stock Exchange were reported to be fairly active this week. Imperial Chemical ordinary units were in larger demand and have improved to 41s. 1½d. at the time of writing. Salt Union lost 3d. to 44s. 9d. B. Laporte were very firm at 126s. 3d., aided by market hopes of a larger dividend or another share bonus distribution. Blythe Colour Works were more active around 12s. 9d. on anticipations that the results will show a further increase in profits and a good final dividend. William Blythe ordinary shares have continued to be held firmly on the possibility of a larger dividend. A larger payment could have been made last year if the directors had not dealt conservatively with profits. Monsanto Chemicals 5½ per cent. cumulative preference were more active with business around 23s. More attention was also given to the preference shares of Morgan Crucible; the 5½ per cent. preference transferred around 26s. 3d. and the 5 per cent. preference around 23s. 6d. In both cases dividend requirements are well covered on the basis of the profits shown by the last report.

There was increased activity reported in the preferred ordinary shares of British Oil and Cake Mills, there being anticipations that a favourable increase in profits will probably be disclosed. United Premier Oil and Cake ordinary shares were also in larger request on the belief that this company is again having a favourable experience. British Glues lost part of the advance referred to last week and are now 10s. 9d. The 2s. shares of British Industrial Plastics transferred actively, but were again 3s. 1½d. British Oxygen showed very active business, and were bought on the view that either a good increase in dividend or a further bonus of some kind can be expected. General Refractories were better at 29s. 6d. in response to the official statement as to the increase in the company's sales. International Diatomite were steady at 7s.

United Molasses at 26s. 6d. have not held all their rise of the previous week, but were again active. Distillers come in for more attention and the shares of Petroleum Storage and Finance continue to attract active interest, having remained under the influence of the statements at the recent meeting. Imperial Smelting were lowered in price in sympathy with the reaction in the price of zinc. Turner and Newall remained rather neglected, but Unilever were active, although little changed in price at 44s. 9d. Triplex Safety Glass reacted of profit-taking following the recent bonus announcement and are 8½ at the time of writing.

Cement shares were more active, largely as a result of the good increase in profits shown by the results of Alpha Cement. The shares of this company have been lowered largely because the market had been looking for a dividend of rather more than the 12 per cent. which is to be paid, but it has to be remembered that a larger capital ranks for dividend and that full benefits of expansion of the business have yet to accrume. Associated Portland Cement were steady, the view having persisted that either an increase in dividend to 25s per cent. or a bonus of some kind can be expected.

Consett Iron, Dorman Long and most other iron, steel and kindred shares showed a stronger tendency this week. Among paint shares chief interest attached to Pinchin Johnson on continued talk of a possible bonus. International Paint were fairly steady on expectations of a larger dividend. Wall Paper Manufacturers deferred have retained the better tendency which developed recently. On the basis of last year's 12½ per cent. dividend an apparently generous yield is offered, and in view of the large margin over the payment last year, there seems reasonable prospects that the dividend may again be maintained. Cotton Textile shares were in good demand on any reaction in prices. Calico Printers preference were bought, but it is generally believed the question of a resumption of dividends on these shares will be left until the results for the whole year are known. Rayon shares were inclined to be steadier on rumours of a possible increase in the prices of viscose and acetate yarns. Trinidad Leaseholds and most leading oil shares made higher prices.

Boots Pure Drug came in for a moderate amount of profit-taking, but were again active on persistent market talk of a bonus.

Weekly Prices of British Chemical Products

PRICES of a number of heavy chemicals have been advanced during the week. Hydrochlorine acid is from 1s. to 1s. 6d. per carboy dearer than a week ago; unground salt cake has been increased by 4s. per ton; solid sodium sulphide, 60/62 per cent., by 10s. per ton, and crystals, 30/32 per cent., by 15s. per ton. A reduction of 27s. 6d. per ton is announced in the price of solid caustic soda, 76/77 deg., and acetic acid 40 per cent each, is quoted at 20s. less than a week ago. There has been an all round increase of ½d. to 1d. per gal. in the prices of benzole and solvent naphtha. In the pharmaceutical section, pure acetic acid, 80 per cent., is now £30 5s. per ton, against last week's price of £32 5s., benzoic acid, B.P., is 1s. 11d. per lb., calcium lactate, 1s. to 1s. 5d. per lb., and iron quinine citrate, B.P., 10½d. (smaller quantities extra). With the exception of the items quoted below the prices of chemical products remain as reported in THE CHEMICAL AGE last week (pages 84-85.)

MANCHESTER.—Generally steady price conditions have been in evidence during the past week throughout the range of chemicals on the Manchester market, and from the point of view of deliveries into consumption fairly satisfactory conditions are reported. There is a relatively good demand against contracts for a wide range of products for the cotton textile dyeing and finishing branches, the position in this direction representing an improvement compared with what it has been during recent years. In the West Yorkshire woollen trade, also, consumption is on a fair scale, while a steady movement is reported in most other directions. Fresh bookings during the past week have been on moderate lines. The demand for the lighter descriptions of by-products is steady and with supplies scarce in a number of sections prices are on an extremely firm basis.

GLASGOW.—There has been a steady day to day demand for chemicals for home trade during the week, but export business has been rather quiet. Prices generally continue firm at about previous figures; several articles, particularly sulphate of copper, being again dearer. There has been a fair demand for most coal tar products throughout the week. Available supplies of cresylic acid are limited, a fact which may account for a growing interest in high boiling fractions. Different grades of these tar acids have been sold round 1s. 10d. to 2s. per gallon, and large quantities are moving in this district. Production of benzol, solvent naphthas and pyridines is well looked after, with prices firm as quoted. Fair quantities of creosote both for home and export have left manufacturers' hands. Some pitch has been booked for forward delivery.

General Chemicals

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £30 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, CITRIC.—1s. per lb. MANCHESTER: 11¾d. SCOTLAND: B.B. crystals, 1s. per lb., less 5%.

ACID, HYDROCHLORIC.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. SCOTLAND: £2 9s. per cwt. in casks. MANCHESTER: £49 10s. to £54 per ton ex store.

ACID, TARTARIC.—11¾d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 11¾d. less 5%. MANCHESTER: 1s. per lb.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36, brown, £35.

POTASSIUM PERMANGANATE.—LONDON: 8¾d. per lb. SCOTLAND: B.P. Crystals, 9¾d. MANCHESTER: B.P. 10¾d. to 11½d.

SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODIUM SULPHIDE.—Solid 60/62% Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SULPHATE OF COPPER.—MANCHESTER: £19 15s. per ton f.o.b. SCOTLAND: £20 10s. per ton less 5% in casks.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 7¾d. to 8d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6¾d.

SALT CAKE.—Unground, spot, £3 16s. 6d. per ton.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 3s. 2d. to 3s. 3d. per gal.; 99/100%, 3s. 6d. to 4s. per gal., according to specification; pale 99%, 3s. 4d. to 3s. 5d.; dark, 2s. 9d. to 2s. 10d. GLASGOW: Pale, 99/100%, 3s. to 3s. 6d. per gal.; pale, 97/99%, 2s. 10d. to 3s. dark, 97/99%, 2s. 6d. to 2s. 9d.; high boiling acids, 1s. 10d. to 2s.; American specification, 2s. 9d. to 3s. 3d.

BENZOL.—At works, crude, 9d. to 9½d. per gal.; standard motor 1s. 3d. to 1s. 3½d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 8d. to 1s. 8½d. LONDON: Motor, 1s. 3½d. GLASGOW: Crude, 9d. to 10d. per gal.; motor, 1s. 2d. to 1s. 3d.

CREOSOTE.—B.S.I. Specification standard, 5¾d. to 6d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North: 5d. London. MANCHESTER: 5½d. to 6d. GLASGOW: B.S.I. Specification 5½d. to 5¾d. per gal.; washed oil, 4¾d. to 5¼d.; lower sp. gr. oils, 5d. to 5½d.

NAPHTHA.—Solvent, 90/160%, 1s. 6½d. to 1s. 7½d. per gal.; 95/160%, 1s. 7d.; 90/190%, 1s. 1d. to 1s. 2½d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 5½d. to 6d. per gal.; 90% 160, 1s. 3d. to 1s. 4d.; 90%, 190, 1s. to 1s. 1d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £11 10s. to £12 10s. per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £7 to £7 10s. per ton (bags free).

PYRIDINE.—90/140%, 8s. to 9s. 6d. per gal.; 90/180, 2s. 6d. to 3s. GLASGOW: 90% 140, 9s. to 10s. per gal.; 90% 160, 7s. to 8s.; 90% 180, 2s. 6d.

Intermediates and Dyes

p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ASTRON MANUFACTURING CO., LTD., Epsom, manufacturing chemists, etc. (M., 30/1/37.) Jan. 14, series of £2,000 debentures, present issue £1,000; general charge. *Nil. January 14, 1936.

HERTFORDSHIRE BRONZE POWDER WORKS, LTD., London, W. (M., 30/1/37.) January 16, debentures, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge.

MIDWAY CHEMICAL CO., LTD., Slough. (M., 30/1/37.) January 15, £100 and £100 debentures, parts of £500 already registered. *Nil. December 31, 1935.

NEWTON AND WRIGHT, LTD., London, W., scientific instrument manufacturers. (M., 30/1/37.) January 18, charge, supplemental to debenture registered October 30, 1936, to Friends' Provident and Century Life Office; charged on yard and buildings, at side and rear of 36 Calverley-gr. Holloway.

Satisfaction

CERAMIC ART CO. (1905), LTD., Stoke-on-Trent. (M.S., 30/1/37.) Satisfaction January 14, of 2nd debenture registered July 15, 1936, to extent of £100.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

CURTIS, A. B. (male), 6 Ludgate Circus Buildings, E.C., manufacturing chemist. (C.C., 30/1/37.) £17 8s. 2d. December 10.

PLIMSOLINE PRODUCTS, LTD., 140 Falkland Road, Hornsey, manufacturing chemists. (C.C., 30/1/37.) £34 12s. 5d. December 16.

YOUNG, GEO. BERTRAM, 16 Worrall Road, Sheffield, metallurgical chemist. (C.C., 30/1/37.) £14 6s. 8d. December 3.

Voluntary Liquidation

JACKSON HUGHES AND CO., LTD., soap manufacturers, Salford. The statutory meeting of creditors was held recently at the Victoria Hotel, Manchester. A statement of affairs was submitted which showed ranking liabilities of £2,015 19s., made up as follows: trade creditors, £1,323 10s. 6d.; cash claim, £42; bankers, £645 13s. 6d.; and partly secured creditors, £44 15s. 1d., holding security valued at £40. In addition there were fully secured creditors for £121 1s. 9d. After allowing £49 11s. for preferential claims the net assets were £559 16s. 9d., or a deficiency of £1,456 2s. 3d., so far as the creditors were concerned. The principal assets were: plant and machinery, £343 2s. 2d., valued at £100; good book debts, £321 4s. 9d.; doubtful and bad debts, £476 7s. 2d., expected to produce £115; and stock, £287 9s. 4d., estimated to realise £50. The issued capital of the company was £1,200, and as regarded the shareholders there was a deficiency of £2,656 2s. 3d., which was attributed to the following items: net loss on trading from July 9, 1935, to September 30, 1936, £1,156; net loss from October 1, 1936, to January 13 last, £335; depreciation writen off the assets, £1,019; and cartons invoiced or charged, but not delivered, and not appearing in the stock, £145. The company, it was reported, was incorporated on July 9, 1935, with a nominal capital of £2,000. The whole of the issued capital of £1,200 was allotted for cash. Trading accounts which had been prepared showed that during the period to September, 1936, the sales were £3,654, with a gross profit of £645, and a net loss of £1,156. During the period to January, 13 last there was a further net loss of £335, on sales of £1,271, the gross profit being £163. It was stated that the cash creditor for £42 would withdraw his claim. After discussing the position it was decided that the voluntary liquidation of the company should be continued with Mr. Wm. Bateson, Stockport, as liquidator. A committee was also appointed consisting of the representatives of Imperial Chemical Industries, Ltd., Wm. Hoyle and Son, and Widnes Soap Co.

Forthcoming Events

LONDON.

Feb. 1.—Society of Chemical Industry (London Section). "Infra Red Photography and its Field of Application." E. R. Davies. 8 p.m. Burlington House, Piccadilly, London.

Feb. 2.—Royal Institution of Great Britain. "Electrical Conductivity in Solids: Its Dependence on Crystal Structure and Crystal Faults. III." N. F. Mott. 5.15 p.m. 21 Albemarle Street, London.

Feb. 3.—Society of Public Analysts and Other Analytical Chemists, and Society of Chemical Industry (Food Group). Discussion on "The Less-Known Constituents of Milk and Their Examination." 5.15 and 8.15 p.m. Chemical Society's Rooms, Burlington House, Piccadilly, London.

Feb. 4.—Chemical Society. "The Transition State in Reaction Kinetics." Professor M. Polanyi. 5 p.m. Burlington House, Piccadilly, London.

Feb. 5.—Institute of the Plastics Industry. Annual dinner and dance. Café Royal, London.

BIRMINGHAM.

Feb. 2.—Electrodepositors' Technical Society (Birmingham Section). "Gilding and Gold Plating." R. E. Close. 7.30 p.m. James Watt Memorial Institute, Great Charles Street, Birmingham.

Feb. 6.—Midland Chemists' Dinner-Dance. 6.45 p.m. Midland Hotel, New Street, Birmingham.

BRISTOL.

Feb. 4.—Chemical Society and Society of Chemical Industry (Bristol Sections). "The Chemistry of Ascorbic Acid and its Analogues." Professor E. L. Hirst. Chemical Department, The University, Woodland Road, Bristol.

FALKIRK.

Feb. 1.—Institute of Vitreous Enamellers (Scottish Section), and Falkirk Branch Institute of British Foundrymen. "Moulding Sands and Facings: Their Effects on Iron and Enamels." Temperance Café, Falkirk.

GLASGOW.

Feb. 5.—Society of Chemical Industry (Glasgow Section). Jubilee Memorial Lecture. "The Service of Science to Industry." Dr. J. T. Dunn. 7.30 p.m. Royal Technical College, Glasgow.

HULL.

Feb. 2.—Hull Chemical and Engineering Society and Guild of Building. "Notes on Reparation Works to Ancient Buildings." A. R. Warnes. 7.45 p.m. Room 57, Municipal Technical College, Park Street, Hull.

MANCHESTER.

Feb. 1.—Institute of the Plastics Industry (Manchester Section). "The Continuous Moulding of Thermo-Setting Compounds." P. A. Delafield. College of Technology, Manchester.

Feb. 2.—Manchester Literary and Philoosophical Society. "Alloys." Professor W. L. Bragg. 5.30 p.m. 36 George Street, Manchester.

Feb. 3.—Manchester Metallurgical Society. Papers by Junior members. 7 p.m. Constitutional Club, Manchester.

Feb. 4.—Institute of Vitreous Enamellers (Northern Section). "Heat Resisting Muffle Equipment." A. L. Fawkes. 7.30 p.m. Queen's Hotel, Manchester.

Feb. 5.—Society of Chemical Industry (Liverpool and Manchester Sections and Chemical Engineering Group). Conference on Atmospheric Corrosion. 10.30 a.m. "Atmospheric Corrosion of Metals." Dr. W. H. J. Vernon. Manchester College of Technology. 5.45 p.m. "Field Tests on Ferrous and Non-Ferrous Materials." Dr. J. C. Hudson. "Practical Observations on Atmospheric Corrosion of Non-Ferrous Materials." E. A. G. Liddiard. Lecture Theatre, Central Library, Manchester.

NEWCASTLE-UPON-TYNE.

Feb. 1.—Bedson Club, Chemical Society (Newcastle and Durham Section), and Institute of Chemitry (Newcastle and North-East Coast Section). "The Transition State in Chemical Reactions." Professor M. Polanvi. 6.30 p.m. Chemistry Lecture Theatre, Armstrong College, Newcastle-upon-Tyne.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—A Bombay firm of manufacturers' representatives desire to secure the agency of United Kingdom manufacturers of chemical plant, preferably on a commission basis, for the whole of India. (Ref. No. 674.)

Belgium.—An agent established near Liege wishes to obtain the exclusive or regional representation, on a commission basis, of United Kingdom manufacturers of refractory materials for steelworks and foundries (excepting mortar and cement). (Ref No. 677.)